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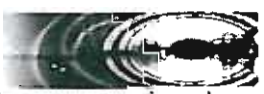

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Monday, May 5, 2008
2:45 PM - 3:45 PM

The Case For and Against Insulation Manufacturers/Distributors

Gilbert Purcell
James Crosby

See accompanying cd-rom for documents and speaker papers

NOTES

STATE-OF-THE-ART: A PRIMER

by

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I. STATE-OF-THE-ART DEFINED

State-of-the-Art has been described as:

> [W]hat and when doctors, mine owners, and manufacturers knew or should have known about the dangers of asbestos, not only to persons working in mines and manufacturing plants, but also to those coming into contact with the product, such as insulators, pipe fitters, and others working in close proximity to the installation or removal of asbestos containing products . . . State-of-the-Art includes all of the available knowledge on a subject at a given time, and this includes scientific, medical, engineering, and any other knowledge that may be available. State-of~the-Art includes the element of time: What is known and when was this knowledge available . . . State-of-the-Art is a higher standard because scientific knowledge expands much more rapidly than industry can assimilate the knowledge and adopt it as a standard.[1]

> Parker next argues that the trial court erroneously determined under the [*478] middleman statute that there was no evidence Petter Supply and Hannan Supply knew or should have known the product was defective. Parker claims the dangers of asbestos were known in the scientific and medical community at the time he was exposed to asbestos, and this created a question of fact which precluded summary judgment. HN6Whether this is a fact issue to be resolved by a jury depends on whether the plaintiff alleged the existence of any fact from [**9] which such knowledge could be inferred. *Funk v. Wagner Machinery, Inc.*, 710 S.W.2d 860, 862 (Ky.App. 1986). HN7A litigant need not be required to try his case on a motion for summary judgment, but he has the burden of showing that a fact issue exists. Id.
>
> Parker showed that the medical and scientific community was aware of defects as early as the time that Parker was exposed to asbestos products. Parker's expert, **Dr. Pohl, testified in his deposition that if asked about it at trial he would testify about when the medical and scientific community knew or should**

[1] Original source unknown

have known of the dangers of asbestos. He stated that he had testified in other cases that the medical community has known about asbestosis as of 1930, about lung cancer and asbestos exposure as of 1943, and the link between asbestos and mesothelioma sometime between 1953 and 1960. He stated that he would testify, if asked, about when manufacturers and distributors knew or should have known of the dangers of asbestos in terms of "state of the art," or scientific knowledge at different points in time, which would be a reflection of what they would, could or should have known.

As to when manufacturers and [**10] distributors acquired knowledge, Dr. Pohl testified that scientific knowledge was available to anyone through medical libraries or publications as well as through lay publications in the 1940s and 1950s, and he could testify to that. He stated that he was aware of some manufacturers and distributors and their knowledge about asbestos, although he did not have specific awareness of Petter Supply's knowledge. He stated that instead he would testify as to what was known in the medical literature as well as what was being published in the lay literature that was available to anybody, even suppliers.

The standard is whether Petter Supply or Hannan Supply knew or should have known. We conclude that the grant of summary judgment was premature. Parker's evidence presented at least an issue of fact that Parker should have been allowed to develop in continued discovery. As stated above, all doubts are to be resolved in favor of the party opposing the motion for summary judgment. *Steelvest*, 807 S.W.2d at 480. Thus, we vacate the trial court's grant of summary judgment. *Parker v. Henry A. Petter Supply Co., 165 S.W.3d 474, 478 (Ky. Ct. App. 2005) (emphasis added)*

The "state of the art" defense is essentially an ability-to-foresee defense. The defense theory is that, at the time of a given asbestos exposure, there was no medical or scientific knowledge of a hazard from asbestos-containing products and, accordingly, there was no duty to warn the users of such products. Whatever its merits generally, this defense is, in any event, unavailing if the defendant had knowledge of a

> hazard associated with its asbestos-containing products and nevertheless failed to warn users. See Complaint in *Wise v. Travelers Indem. Co.*, No. 01-C-599 (W. Va. Cir. Ct., Berkeley County, Oct. 25, 2001) (Docket No. 3415, Ex. L), at PP 180-201. Johns-Manville Corp. v. Chubb Indem. Ins. Co. (In re Johns-Manville Corp.), 517 F.3d 52, 58(2dCir.2008).

The following pages set forth a summary of the State-of-the-Art (SOTA) or "ability-to-foresee" defense as may be asserted by manufacturer or asbestos insulation company. An overview of how one may challenge the State-of-the-Art defense is also provided.

II. DEFENSE STATE-OF-THE-ART OR INABILITY TO FORESEE

Asbestosis

Montague Murray first reported a case of asbestosis in 1906 before the British Department Committee on Industrial Disease.[2] Technically, this report was not published in the "medical and scientific literature" and thus, his findings were not widely distributed. In fact, when W.E. Cooke, M.D. reported another case in 1924, but he made no reference to Montague Murray's earlier report. The first reference to Murray's "case" in the medical literature was by Cooke in his 1927 article. Drs. Cooke, McDonald and Oliver each authored reports in 1927 and coined the word "asbestosis"[3].

Considerable doubt was cast upon the validity of a distinct fibrotic disease attributed to asbestos by Pancoast & Pendergast in 1925, who believed that contamination of asbestos with silica was responsible for the deleterious effect on the lungs. The Pancoasts' article does not give the employment histories of his asbestos workers, therefore, we do not know the nature and extent of their exposure. Furthermore, we do not know that they had "asbestosis" since the nature and extent of their disease was not fully described and since that disease entity had not yet been named. A claim for occupational disability due to asbestosis was upheld as early as 1927 in Massachusetts and as of 1932 the U.S. Government paid a compensation claim.

Several articles in medical and public health publications deplored the dusty working conditions in mines, mills and factories. Asbestos dust was sometimes mentioned, but not distinguished from other dusty materials in most instances. Some authoritative publications suggested that asbestos dust might be less harmful than other dusts. For example, Pancoast in 1925 stated, "In dusty factories, such as asbestos and cement works, cleanliness and ventilation are essential, although the actual danger in these two industries seems to be comparatively slight . . . ".

In 1929 the Metropolitan Insurance Company was asked by certain asbestos industry officials to ascertain "whether asbestos dust was an occupational hazard and, if so, what was the nature of

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[2] M. Murray, *Report of the Dept. Committee on Compensation for Industrial Diseases*". London 1907.

[3] W. E. Cooke, *Fibrosis of the Lungs Due to the Inhalation of Asbestos Dust*, Brit. Med. J. 2:147. 1924; W. E. Cooke, *Pulmonary Asbestosis*, British Medical Journal, p.1024-1025. December 3, 1927.

this hazard and what should be done to prevent or control it." Dr. A.J. Lanza, Assistant Medical Director of the Metropolitan Life Insurance, undertook the study of this subject. Dr. Lanza published and summarized the results of his study in his article "Asbestosis" which appeared in the most widely read medical journal in the United States, the Journal of the American Medical Association (JAMA)[4]. Dr. Lanza stated: "In our studies of asbestos mines and fabricating plants, the clinical picture of asbestosis was milder than that of silicosis", and "[a]ll of the patients with asbestosis that were detected were, with one exception, working steadily at their trades". Dr. Lanza went on to state:

> [o]ne feature that has impressed us is that the British investigators found asbestosis more severe and more menacing than we did...in both countries, energetic steps have been taken to control the dust hazard in asbestos plants, so that it is probable that further cases of disabling asbestosis will be rare...[A]sbestos plants are being cleaned up and the dust is being controlled. This, together with the smaller number of persons employed, implies that there will probably never be the wealth of clinical material that has been available in silicosis.[5]

In the 1930's relatively few non-academic American physicians would have read British journals. Although the British had seen more historical cases of asbestosis, they also had since instituted control measures to address dust levels in asbestos factories. Same or similar controls were also instituted for non-asbestos manufacturing factories. (Although these control measures were implemented in 1931, they were not fully effective until 1933). It was widely believed then, and for many years to

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[4] A.J. Lanza. *Asbestosis*. JAMA. 106:368-369 (February 1936); see also; A. Lanza. *Effects of the Inhalation of Asbestos Dust on the Lungs of Asbestos Workers*. Public Health Report. (January 1935).

[5] Note the following abstract: "A cross-sectional prevalence survey of asbestosis, including all 1,140 employees of a diversified asbestos products manufacturer, was conducted in 1932 by Drs. Anthony J. Lanza and Frank V. Meriwether. Occupational histories were obtained from workers in order to identify job tasks with exposure to asbestos and other fibrogenic dusts. Abbreviated medical histories, physical examinations, fluoroscopy, and chest radiographs were performed. Radiographs were interpreted according to applicable criteria for pneumoconiosis, the presence of which was confirmed in 327 subjects (29%). Among those, 64% had previous exposure to dusts in addition to asbestos, coal being the leading non-asbestos exposure. Thirty-six percent of cases had prior exposure only to asbestos dust. The original conclusions do not survive. Contemporaneous related documents suggest that the original authors believed asbestosis to be a milder form of lung disease than silicosis. It was subsequently recommended that the company institute pre-employment physicals, including chest radiographs; not hire people with prior coal-dust exposure; warn workers against excessive exposure to asbestos dust; remove those with disease to less dusty areas; and begin periodic medical surveillance for pneumoconiosis. The study, which has never appeared in the medical or scientific literature, holds important lessons for those concerned with occupational health today and in the future." [Abstract] Am. J. Ind. Med. 31:324-334, 1997. © 1997 Wiley-Liss, Inc.

follow, that these dust control regulations would prevent significant occurrences of asbestosis in the future.

Asbestosis was an uncommon disease in the 1930's in the United States. Any individual consulting the medical literature would have been reassured that asbestosis was in fact a rare or disappearing disease.

During the decade between 1937-1946 following significant events occurred profoundly affecting the medical and industrial opinions concerning asbestos for the 20+ years that followed:

1. Threshold Limit Value (TLV) Established. Threshold limit value is generally defined as the maximum concentration of any agent which one may encounter over a normal working day and week for a normal working lifetime without the fear of any serious consequences.[6]

In 1938 the United States Public Health Service established a probable "safe level" that was believed adequate to prevent asbestosis.[7] The level was 5,000,000 particles per cubic foot of air (5 mppcf) equivalent to approximately 185 particles per cubic centimeter of air, roughly equal to the British level. On page 117 of the report the authors concluded:

> It would seem that if the dust concentration in asbestos factories could be kept below 5 million particles (the engineering section of this report has shown how this may be accomplished), new cases of asbestosis probably would not appear.

The American Conference of Governmental Industrial Hygienists (ACGIH) accepted and established this threshold limit value in 1946. This standard was often reviewed by the ACGIH and, except for occasional clarification, was confirmed as adequate.

2. Commander Brown's Naval study of shipyard insulators found no significant cases of asbestosis in U.S. shipyards.

3. World War II. A true world war was fought involving battles throughout Europe, much of Northern Africa, portions of Asia, and many South Sea Islands. Eventually, some say reluctantly,

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[6] 9 Annals of the American Conference of Governmental Industrial Hygienists, (Marshall E. LaNier ed., 1984)

[7] W.C. Dreessen , *A Study of Asbestosis in the Asbestos Textile Industry*, Public Health Bulletin No. 241, August 1938. A shorter version was published in 1939 in the Journal of Public Health that clearly stated the safe level was five million particles of asbestos dust per cubic foot.

the U.S. entered the war providing troops, munitions, air crafts, and war ships. After Pearl Harbor the U.S. was called upon to not only built a larger arsenal of war ships, but to also replace those destroyed by the Japanese attach. Winning the war was essential to the survival of the U.S. and democracies elsewhere. Winning was the paramount objective of the U.S. Government and industry, and to do so required mobilizing a huge work force to produce weapons as well as war materials and equipment. This work force was often subjected to less than ideal working conditions. The ship building industry consumed vast amounts of asbestos under conditions that are now recognized as hazardous but at the time were not appreciated as such.

4. 1946 Study of Shipyard Workers a/k/a "The Fleischer-Drinker Study". In 1946 a group of U.S. Navy health consultants, W. Fleischer, F. Viles, Jr., R. Gade, and P. Drinker[8] wrote an influential article entitled *A Health Survey of Pipe Covering Operations in Construction of Naval Vessels* that was published in the Journal of Industrial Hygiene and Toxicology. This survey of four shipbuilding yards involved some 1,683 workers. Chest x-rays were made of 1074 workers and, by the standards of the time, extensive measurements of the quantity and characteristics of airborne dust were carried out and reported in meticulous detail. Their findings, which were very clear and convincing, indicated that despite the heavy concentration of dust, almost no evidence of asbestos disease was found. Fleischer-Drinker concluded:

> 1. The character of asbestos pipe covering industry on board naval vessels is such that conclusions drawn from other asbestos industries such as textiles, cannot be applied.
>
> 2. The operations of band saw cutting, grinding, cement mixing, and installation on board ship should be equipped with exhaust ventilation to keep the total dust concentration low.
>
> 3. The incidence of asbestosis among pipe coverers in the shipyards studied was low, 0.29 percent or 3 cases out of 1074. In view of the nature of shipyard pipe covering work, this low incidence is not surprising.

[8] Philip Drinker was the inventor of the "iron lung" that saved the lives of many polio victims. He was also one of the early professors at the Harvard School of Public Health.

> 4. Since each of the 3 cases of asbestosis had worked at asbestos pipe covering in shipyards for more than 20 years, it may be concluded that such pipe covering is not a dangerous occupation. (p16).

There were no additional significant epidemiologic studies of a large cohort of insulation workers *in the United States* until Dr. Selikoff's study of 1964. Furthermore, there was no published criticism of the Fleischer-Drinker study between 1946 and Selikoff's study of 1964[9].

In England and in Europe reported cases of asbestosis continued to increase, but appeared to be limited to those exposed prior to the 1933 Regulations. Occasional reports of asbestosis and lung cancer also appeared and caused concern in England and Europe. The United States began to see a few case reports, but no real concern seemed to have been created as asbestosis was also generally reported as present and other confounders were not ruled out.

There were reported incidences of asbestosis among textile workers during this period. The International Labor Office expressed concern about these textile factories, but the U.S. Public Health Service Report (Dreesen) was reassuring because it continued to support the opinion that 5 million particles per cubic foot was a safe level.

Beginning in 1946 the ACGIH published TLVs (Threshold Limit Values) for various substances. That year the TLV for asbestos was listed at five million particles per cubic foot. The TLV for asbestos remained at five million particles per cubic foot until 1970. During this period there were limited published criticisms of this TLV. (Marr, Balzer, Cooper, and Selikoff)[10]

Cancer

During the next decade (1947-1956) lung cancer began to appear with increasing frequency among all individuals, including those exposed to asbestos. Isolated cases of lung cancer among asbestos workers who smoked had appeared in the U.S. literature

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[9] Dr. Selikoff later referred to the study as "useful". I.J. Selikoff, Ruth Lilis, & Wm. Nicholson, *Asbestos Disease in United States Shipyards*, Annals New York Academy of Sciences, 1979.

[10] W.T. Marr, *Asbestos Exposure During Naval Vessel Overhaul*, 25 Am Ind. Hyg. Assn J. 264-268. (1964); J.L. Balzer & W.C. Cooper, *The Work Environment of Insulation Workers*, 29(3) Am Ind. Hyg. Assn J. 222-227. (1968); I.J. Selikoff, J. Churg, & E.C. Hammond, *The Occurrence of Asbestosis among Insulation Workers in the United States*, 132 Annals of the New York Academy of Sciences 139-155 (December 31, 1965)

since 1935[11], however, these instances were not significant when compared to incidences among the general population of smokers and virtually none of the asbestos cases gave smoking histories of the individuals studied.

The subject of cancer and *asbestosis* was definitely controversial until Sir Richard Doll's 1955[12] epidemiologic study showed a significant prevalence of carcinoma among certain asbestos textile workers in England. Prominent authorities had long been skeptical of any association of a causal nature. Doll's study dealt with textile workers who were all *exposed prior to the dust suppression regulation* and all with lung cancer also had **asbestosis.** This autopsy-based study did not end the lung cancer controversy and it did not mention insulators or other end users. The oft-quoted study by Dr. Doll concluded:

> . . .lung cancer was a specific industrial hazard of certain asbestos workers and that the average risk among men employed for 20 or more years has been of the order of 10 times that experience by the general population. *The risk has become progressively less as the duration of employment under the old dusty conditions has decreased.* (emphasis added, p86)

One shortfall of this study is that Dr. Doll, one of the early researchers on cigarette smoke and lung cancer, did not address and assess the critical tobacco factor.

The pathology, radiology and symptomatology of asbestosis became clarified in an increasing number of reports. However, these reports often dealt with small cohorts and nearly always made special mention of unusually heavy exposure levels. The TLV of 5mppcf of air was still considered to be a safe level, approved by the ACGIH and others in the field of occupational medicine.

In the United States cases of asbestosis were rarely encountered, even in communities where there had been heavy exposures during the previous decade. However, the necessary "latent period" had not expired.

In England, where asbestos had been used for longer periods and in heavily contaminated textile mills, asbestosis was receiving much more attention than in the United States. Even in England

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[11] K M Lynch & W A Smith, *Pulmonary Asbestosis. III: Carcinoma of Lung in Asbesto-Silicosis,"* 24 Am. J. Cancer. 56-64 (1935): see. also. K J Isselbacher. H. Klaus. and H L Hardy. *Asbestosis and Bronchogenic Carcinoma: Report of One Autopsied Case and Review of the Available Literature,* 15 Am. J. Med.. 721-732 (1953).

[12] Sir R H Doll. *Mortality From Lung Cancer in Asbestos Workers,* 12 Brit. J. Ind.. Med.. 81-86 (1955)

this disease was rare in comparison with other deaths due to lung fibrosis. For example, the Annual Report of the Chief Inspector of Factories for 1956 reported that between 1949 and 1956 there had been 17,328 deaths from occupational lung fibrosis. Of those, only 123 were due to asbestosis. Thus, other causes of death from lung fibrosis were 140 times greater. Consequently, it can be concluded that asbestosis was a rare cause of fatal dust disease, even in England, and medical science was likely more focused on the more common causes of this condition.

Any student, physician or individual who examined the literature in 1956 concerning asbestos-related diseases would not know, and could not have known, the extent of the problem that appeared later. As of 1956 one would properly conclude that in the United States, asbestosis was a rare disease that could well be controlled by existing methods. What was written and known, or should have been known, in 1956[13] is very different from what is known or believed to be true 50 odd years later.

It was not until the mid-1960's, that some medical literature began to be available to United States physicians, and others describing potential risks to large numbers of workmen whose environment had been previously regarded as safe. The effects of war-time exposures were now becoming manifest in the United States.

An important turning point in United States medical and scientific literature was the December 31, 1965, publication of the transactions of the International Conference on the "Biological Effects of Asbestos", published in the Annals of the New York Academy of Sciences. Although the general medical community infrequently saw this journal, publications in medical journals eventually brought much of the material discussed at the conference to the attention of the medical community. Additional studies by other authors of separate groups also reach some of the conclusions of the conference. This has lead to the acceptance of some of the studies presented at the 1964 conferences.

The report of Dr. Selikoff at the *New York Academy of Sciences* in 1964 concerning asbestos-related diseases among a large group of insulation workers has, with time, exerted a profound

[13] E C Hammond & W. Machle, *Environmental and Occupational Factors in the Development of Lung Cancer*," in: Pulmonary Carcinoma, Pathogenesis, Diagnosis and Treatment, pp. 41-61, (Mayer & Maier eds., 1956) New York U. Press. Suspected cause but evidence for causal role insufficient.

influence on the opinion of United States physicians. Selikoff, *et al* concluded in the report, which was published in 1965 and mailed out to attendees and subscribers in 1966 that " . . . asbestosis and its complications are significant hazards among insulation workers in the United States at this time."[14] (p152) It was from this paper that most physicians first became aware of the hazards that might be associated to those casually or intermittently exposed to asbestos, i.e. shipyard workers or insulators, as opposed to those persons exposed in textile factories. Dr. Selikoff admitted that "the first cases of asbestosis were in textile workers" (p139) and he reported to the conference that insulation workers who had entered the trade **between 1923 and 1942** had an **excessive death** rate **from lung cancer**. He also noted an increase in the prevalence of other cancers, but Dr. Selikoff refrained from drawing conclusions on this subject. At pages 151-152 of his report Dr. Selikoff states:

> "Scattered case reports have previously been recorded of neoplasms among insulation workers, including both lung cancer and mesothelioma of both the pleura and peritoneum. A lung cancer has also been reported in workman in a factory making asbestos insulation. However, these reports, while interested and valuable, could not establish an association between the two conditions. It is possible that additional lung cancers and mesotheliomas have occurred and may even have been reported but such reports do not state the nature of the asbestos exposure and such instances may be included among cancers in 'asbestos workers'."

It is important to note that these men must have worked during and prior to the war years when exposures were likely excessive—probably above the 5 mppcf TLV promulgated in 1938. One important factor to keep in mind is that Selikoff, *et al* did not consider (in this study) the insulators' cigarette smoking history in the analysis of the data.

Through Dr. Selikoff's study, major interest in the area of asbestos exposure developed. Even of the physicians attending this conference would not receive their copies of the materials presented until 1966, and at this time most people thought that asbestos and its related diseases was of declining interest.

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[14] I.J. Selikoff, et al. *The Occurrence of Asbestosis among Insulation Workers in the United States*, 132 Annals of the New York Academy of Sciences 139-155 (December 31, 1965)

After Dr. Selikoff's presentation, interest was aroused and studies followed to ascertain if his results could be replicated. As in any worthy profession, ideas, hypotheses, and theories that develop must be tested before they become established principles.

Mesothelioma

It was during the period from 1956-1966 that medical doctors and scientists for the first time truly associated mesothelioma with certain asbestos exposures. Although arguably there had been other even more obscure reports on the subject, Wagner and associates, in several articles published between 1959 and 1962[15] first showed this potential relationship by reporting on a prevalence of this disease in parts of South Africa where **crocidolite asbestos** was being mined and handled in a manner unlike that customarily employed in England and the United States. Hammond and Selikoff later reported, in 1965, that 10 mesothelioma deaths had occurred among 307 deaths of insulation workers over a 21-year period (1943-1964).

Although primary pleural and peritoneal malignant mesothelioma are very rare diseases, with a high association with asbestos exposure, there are significant cases of mesothelioma reported in the medical literature of persons with no asbestos exposure. In December of 1971, Dr. Oels[16] published the review of 37 patients diagnosed with malignant mesothelioma and found that only 27% of these patients—3 with "known" and 7 with "probable" exposure to asbestos. Subsequent research has determined that additional non-asbestos causes of mesothelioma exist. Crocidolite asbestos is generally the type most associated with mesothelioma.

TLV Reductions

During the period 1967 through 1986, the medical and scientific literature concerning asbestos and health grew and continues to grow exponentially. Opinions and predictions of previous decades sometimes became accepted as "facts" and those "facts", whether accurate or not, were disseminated to the medical community and the general public, some rising to the level of "legend" or "myth". But, there remained (and remain) a number of controversial issues, including non-respiratory tract cancers,

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[15] For example, J.C. Wagner, et al *Diffuse Pleural Mesothelioma and Asbestos Exposure in the North Western Cape Province* 17 Brit. J. Ind. Med. 260-271 (1960)

[16] H.C. Oels. *Diffuse Malignant Mesothelioma of the Pleura: A Review of 37 Cases* 60(6) Chest 564-570 (December 1971)

lung cancer among non-smoking asbestos exposed, the role of community air pollution with natural and/or industrial asbestos, the existence (or not) of a safe level of asbestos in the work place, the significance of ultramicroscopic fibers in normal lungs of the general population, and the relative risks of the different types of asbestos fiber as compared with the thousands of known substances which are suspected carcinogens.

In 1968 J. Leroy Balzer and W. Clark Cooper, M.D.[17] undertook a study of the environmental exposures and the health of insulating workers in the San Francisco Local Union #16. Although they observed that the threshold limit value for asbestos may be too high, they made no conclusion as to the adequacy of the threshold limit value of 5 million particles per cubic foot as set by Dreesen and adopted by the ACGIH in 1946 and which remained in effect in 1968.

Most chest physicians and the scientific community knew Dr. George W. Wright's research and investigation over many years in this field. His summary on State-of-the-Art[18] is especially significant because it was compiled only a few years after the conference held by the New York Academy of Sciences in 1965.

After reviewing the literature, Dr. Wright concluded that:

> An approximation of the concentration of respirable sized asbestos fiber that can be tolerated without risk of pulmonary fibrosis has been achieved. There is reason to believe that this concentration will also minimize the risk of pulmonary malignancy including mesothelioma. (p 447)

In 1968, the ACGIH gave the following notice that the TLV for asbestos would be lowered.

NOTICE OF INTENDED CHANGES

> These substances, with their corresponding values, comprise those for which either a limit has been proposed for the first time, or for which a change in the "Recommended" listing has been proposed. In both cases, the proposed limits should be considered trial limits that will remain in this listing for a period of at least two years. During this time, the

[17] See, footnote 10.

[18] G W Wright, *American Review of Respiratory Disease-Asbestos and Health in 1969*[41] 100(4) Respiratory Disease October 467-479 (1969)

> previously Recommended Limit will remain in effect. If, after two years no evidence comes to light that questions the appropriateness of the values herein, the values will be placed in the "Recommended" list. Documentation is available for each of these substances."

The 1968 revision with respect to asbestos states: "Twelve fibers per milliliter greater than five microns in length (as determined by the membrane filter method at 430 x phase contrast magnification), or 2 mppcf (as counted by the standard impinger, light field count technique)".

In 1969 the ACGIH not only adopted threshold limit values for numerous substances, but also included an Appendix A which noted "Because of the high incidence of cancer, either in man or in animals, no exposure or contact by any route, respiratory, oral or skin should be permitted for the compounds: ... " The various compounds listed do not include asbestos. The Appendix A recommended that the TLV for various petroleum distillates and/or gasoline would depend on the content of the various materials rather than a single TLV for all types of these materials. Hence, it is obvious that the organization was sophisticated enough to know that where appropriate different TLVs should be applied to different substances even if they come under the same "generic" category. No such recommendation was made with respect to the various types of asbestos.

In 1970, the TLV for asbestos as adopted by the ACGIH was apparently the "Recommended Limit" of 1968. Then, in 1971, the following "Notice of Intended Changes (for 1971)" provided:

> These substances, with their corresponding values, comprise those for which either a limit has been proposed for the first time, or for which a change in the "Adopted" listing has been proposed. In both cases, the proposed limits should be considered trial limits that will remain in this listing for a period of at least two years. If, after two years no evidence comes to light that questions the appropriateness of the values herein, the values will be reconsidered for the "Adopted" list. Documentation is available for each of these substances.

Among the several substances are listed is:

> Asbestos (all types)-5 fibers per milliliter greater

> than 5 microns in length (as determined by the membrane filter method of 400-450x magnification (4 mm objective) phase contrast illumination.) Concentration 5 fibers per milliliter but not to exceed 10, may be permitted for 15-minute periods each hour up to five times daily.

As in 1968, there is an Appendix A reiterating the information relating to cancer, and again, asbestos is not listed.

Also, in 1971, the U.S. Department of Labor, via OSHA, increased the profile of the federal government in regulating asbestos levels in the work place. OSHA adopted the existing federal standard for asbestos as it existed under the Walsh-Healy Public Contracts Act, 12 f/cc, this was higher than the ACGIH proposed TLV of 5 f/cc.[19]

The TLV for asbestos adopted in 1974 by the ACGIH provided: "Asbestos-5 fibers per cc 75 microns in length; (as determined by the membrane filter method at 400-450x magnification (4 mm objective) phase contrast illumination). A1a"

The "A1a" is a reference to Appendix A1a which is defined in the "Notice of Intended Changes Appendix A Carcinogen in the 1976 Threshold Limit Values for Chemical Substances and Physical Agents in the Workroom Environment", which states in part:

> The Committee lists below those substances in industrial use that have proven carcinogenic in man, or have induced cancer in animals under appropriate experimental conditions. Present listing of those substances carcinogenic for man takes three forms: Those for which a TLV has been assigned (1a), those for which environmental conditions have not been sufficiently defined to assign a TLV (1b), and (1c), those whose reassignment of a TLV is awaiting more definitive data, and hence should be treated as a 1-b carcinogen.
>
> A1a. Human Carcinogens. Substances or substances associated with industrial processes, recognized to have carcinogenic or co-carcinogenic potential, with an assigned TLV: Asbestos, all forms*-5 fibers per cc, greater than 5 microns in length.

[19] For a brief overview of OSHA until 1992 go to http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=PREAMBLES&p_id=784

The asterisked comment is: "Cigarette smoking can enhance the incidence of bronchogenic carcinoma from this and others of these substances or processes."

It is somewhat confusing that the notation relating to Ala is written out in 1976 but referred to in 1974, however, we have no explanation for this. It should be noted that an indication of Ala is not the same as the previously quoted Appendix A A1 recommending no contact with certain substances.

In 1975, the ACGIH established a new value for asbestos (all forms) to indicate the Ala reference with respect to milligrams per cubic meter and had no recommended value for parts per million as in past years.

The ACGIH noted in 1974 that by publication of the Federal Register (Volume 36, No. 105, May 29, 1971) the threshold limit values for 1968 were adopted as the official Federal standards for industrial air. In 1976, the TLV for asbestos (all forms) continued to reference Ala. Even so, as of 1976 with asbestos under that appendix it was still stated to have a TLV of 5 fibers per cc, greater than 5 microns in length. Cigarette smoking was indicated as an enhancing factor with respect to the incidence of bronchogenic carcinoma.

In 1978, asbestos again was placed on the Notice of Intended Change List, however, there was no statement as to what the intended change was to be has been located. But, in 1980, the asbestos TLVs were presented as follows under the heading "Mineral Dust":

Asbestos	
Amosite	0.5 fibers greater than 5 microns per cc, Ala
Chrysotile	2 fibers greater than 5 microns per cc, Ala
Crocidolite	0.2 fibers greater than 5 microns per cc, Ala
Other forms	2 fibers greater than 5 microns per cc, Ala"

The same TLVs for the various asbestos fibers were republished

in 1981.

While the ACGIH continued its efforts, Balzer and Cooper published their 1968 study regarding TLVs. Wright (1969) opined that the asbestos problem should be under control with the proposed lower TLVs. In 1971, Murphy et al, published their work in the New England Journal of Medicine on December 2 pointing out that their study of insulation workers emphasized that low concentrations of asbestos could lead to pulmonary fibrosis and that their study supported the need for lower threshold limit values. Subsequently, in 1972, Selikoff, Churg and Hammond published their work *Carcinogenicity of Amosite Asbestos* in Volume 25 of the Archives of Environmental Health stating:

> Few data exist concerning the comparative neoplastic potential of the several kinds of asbestos in man. Some information is available for chrysotile, crocidolite, and anthophyllite. **However, there has been no evidence to indicate whether or not the amosite variety is also carcinogenic.** (Emphasis added)

In 1972, in light of the work of the ACGIH and other members of the medical and scientific community, the United States Government via OSHA (for the first time) required a warning or caution label by employers with respect to certain asbestos thermal insulation products.

Because of the lag time between publication of medical and scientific information (and acceptance of new data such as the information contained in the Annals of the New York Academy of Science that were published on December 31, 1965) and the sound scientific expectation that new theories and beliefs should be confirmed or replicated, it was not inconsistent with the available medical and scientific data and was in keeping with the laws of the United States not to warn on certain asbestos containing products until 1972 at the earliest.

III. PLAINTIFFS STATE-OF-THE-ART OR ABILITY TO FORESEE[20]

What follows is a general outline of a Plaintiffs' presentation of the State-of-the-Art based upon medical and scientific literature. In other words, how does the medical and scientific literature demonstrate that manufacturers and/or insulation companies or contractors knew or should have known of the health aspects of asbestos and taken steps to avoid potential harm to makers or users of asbestos containing insulation products. **This outline does not address specific documentation that may be in existence from the historical files of various corporations or other sources.**

Asbestosis

Generally, the Plaintiffs contend that knowledge of fibrosis of the lungs due to asbestos exposure has existed since ancient times. The first "modern" reference to the potential hazards of exposure to asbestos is the 1898 and 1899 Reports of the British Inspectorate of the Factories. Those reports expressed observations of the jagged and spear-like nature of the fibers under microscopic examination and the dusty conditions involved in the manufacturing process. Occasionally, mention is made of the fact that Mr. Johns (of Johns-Manville fame) died in 1899, allegedly of asbestosis. While it is known that Mr. Johns died of a lung disease, it is not known that he died from asbestosis. The Plaintiffs then move to 1907 referencing Montague Murray's case of an asbestos worker who died in 1900. Frequent mention is made of the Pancoast article of 1917 referring to asbestos workers with lung disease. Reference is also made to an article by Hoffman in 1918 in which it is alleged that asbestos workers were not able to get life and health insurance. (Hoffman's 1918 article is, in fact, a plea for the discovery of a safe way to use asbestos, since asbestos would obviously play a major role in industrial safety.)

The Plaintiffs contend that Cooke's 1924 article regarding the death of an asbestos worker put the medical community on notice that asbestos workers were subject to contracting a fibrous condition of the lung. The Plaintiffs' attorneys further contend that Cooke's follow-up article in 1927, published in conjunction with two other articles, not only identified the 1924 death but also mentioned the Montague Murray report. These articles coined the term "asbestosis" and made reference to "curious bodies", later to become known as ferruginous bodies.

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[20] With some defense oriented comments

The reports by Murray, Cooke, McDonald and Oliver, taken in conjunction with the various reports of the British Inspectorate of the Factories, prompted Merewether and Price to undertake an epidemiological study of the asbestos textile industry in Great Britain. This study, according to Plaintiffs, revealed that anyone working with asbestos was at risk of contracting an asbestos-related disease. This is evidenced by the British version of the report, which referred not only to the factory workers, but also allegedly to insulators and finishers.

Most Plaintiffs' experts contend that with the publication of the Merewether report in 1930, the entire "asbestos industry" was on notice that anyone exposed to an asbestos fiber was at risk of contracting asbestosis. After all, an asbestos fiber is an asbestos fiber and a lung is a lung. The fiber does not discriminate by job description. Therefore, an employee engaged in an allied trade at a shipyard or on a construction site is equally at risk for contracting this disease as the employees directly engaged in asbestos mining and milling or the manufacturing of asbestos-containing textile products. At this time, cancer is not yet an issue since no cases have been reported. Interestingly, some argue that knowledge of asbestosis was known by the industry and specialists in the field prior to the word first being coined by Cooke in his 1927 article. These experts contend that Cooke used the word "asbestosis" as a result of conversations with the physicians and experts in industry prior to its use in his 1927 article.

Having shown that everybody knew of the dangers of asbestos and asbestosis by 1930, the Plaintiffs then proceed to demonstrate that this knowledge was certainly appreciated in the United States by virtue of the appearance of articles by Mills, Russell, Willson, and Lanza. The Lanza study (1935) demonstrates, according to Plaintiffs, that Dr. Lanza was "a tool of industry". However, Dr. Lanza's study established that by 1935 it was not yet practicable to establish a standard for the asbestos fiber levels in the air. Dr. Lanza's study concludes at page 11:

> 3. A predisposition to tuberculosis due to asbestos dust was not indicated in this study.
>
> 4. Asbestosis as observed in this series of cases had not resulted in marked disability in any case.
>
> 6. It is not practicable as yet to establish standards for the asbestos dust content of air.

From this point, the Plaintiffs and their experts generally contend that a "safe" level of exposure to asbestos has never been established. Rather, they contend that Dreessen (1938), Fleischer/Drinker (1946), the ACGIH (1946-1972), and the United States Government have all shown that no safe level of exposure exists. One of the Plaintiffs' experts' favorite statements is that there is still no known "safe level" for exposure to asbestos.

Cancer

The Plaintiffs' experts typically make no distinction between lung cancer caused by "asbestos exposure" and lung cancer resulting from asbestosis. Overall, the Plaintiffs argue that asbestos is a carcinogen, asbestos is asbestos, a lung is a lung, a human is a human, and therefore, once it was known that individuals exposed to asbestos (regardless of the level) could contract lung cancer, then it was known that asbestos would cause a cancer in all humans. Consequently, the Plaintiffs maintain that distinctions based on the kind of cancer involved (lung cancer versus gastrointestinal cancer versus mesothelioma versus colorectal cancer, etc.) are meaningless.

The first case report in the United States demonstrating an association between lung cancer and asbestos exposure was that of Lynch and Smith in 1935. (Wood and Gloyne published a report in England in 1934.) Lynch followed this case report with another report of two additional cases in 1939. Each of these case reports, as well as others not herein referred to, are of individuals engaged in the mining and milling of asbestos. In 1942, Holleb and Angrist (Angrist was an expert for Plaintiffs prior to his death) published a case report involving insulators with pulmonary asbestosis and bronchogenic carcinoma. Angrist, when he testified live (and now by videotape) was of the opinion that the issue of the relationship between lung cancer and asbestos had been resolved with that case report.

Most Plaintiffs' experts express the opinion that warning flags were rising in the mid to late 1930's, and were flying high between 1942 and 1949 when an unsigned editorial (generally attributed to Heuper) appeared in the Journal of the American Medical Association. (For the defense, it is important to point out that this article refers to "asbestosis and cancer of the lung").

This article is a starting point for the Plaintiffs to seek to obliterate the defense of the five million particles per cubic

foot TLV in cancer cases. The pervasive theory of the medical and scientific community at this time, 1949, was that if asbestosis was not present, then cancer would not occur since the scarring or fibrosis associated with asbestosis caused cancer, and not asbestos alone. The Plaintiffs contend that this article sets forth the general view of the American Medical Association, and hence the general medical community, that there was a relationship between asbestos exposure and cancer. This editorial in 1949 was based upon several articles, including the 1947 Annual Report of the Chief Inspectorate of Factories in England which, in the opinion of its author, Merewether, demonstrated an excess of lung cancers in asbestos factory workers with asbestosis. The report of the Chief Inspector and the JAMA editorial also noted the occurrence of cancer of the pleura in these individuals. During the early 40's there had been a few case reports of cancer of the pleura.

Plaintiffs and their experts then move to the article by Isselbacher and Hardy of 1953 showing lung cancer in insulators using asbestos. The Plaintiffs and their experts then generally contend that by 1955, with the publication of the article by Sir Richard Doll, it was firmly established that there was a relationship between asbestos exposure and cancer of the lung. The Plaintiffs' experts will discredit the Braun and Truan report of 1958 on the basis that it was sponsored by the Quebec Asbestos Mining Association. Drs. Braun and Truan concluded:

> On the basis of what are believed to be complete and reliable data, it seems fair to conclude that the asbestos miners in the Province of Quebec do not have a significantly higher death rate from lung cancer than do comparable segments of the general population.
>
> Furthermore, the death rate from lung cancer in the areas contiguous to the asbestos operations is comparable to that in areas widely scattered throughout the Province of Quebec and is lower than in some urbanized areas within the Province. (p651).

In fact, one Plaintiffs' expert, Thomas Mancuso (d. 2004), in approximately 1961, authored an unpublished critique of the Braun and Truan study criticizing its conclusions and methodology. While this critique was not published in the medical and scientific literature, it was purportedly made available to at least one company.

During the period of 1959 through 1961, Dr. Christopher Wagner

(d. 2000) published a series of articles relating to asbestos exposure and primary mesothelioma of the pleura and peritoneum. Plaintiffs generally contend that the case reports during the 1940s and 1950s suggested a causal relationship between asbestos exposure and malignant mesothelioma and that the study by Wagner in 1960 established this causal relationship beyond all doubt. One Plaintiffs' expert, Gerrit W.H. Schepers, contends that physicians, and those involved in the industry, were aware of the relationship between asbestos exposure and lung cancer and asbestos exposure and mesothelioma in the mid to late 1930's. He bases his opinion on his unpublished necropsies of lung cancers and mesotheliomas in asbestos miners that were accepted during that period in South Africa, and that subsequent publications on these studies merely confirmed what was already known. Other Plaintiffs' experts are generally of the opinion that the lung cancer connection was established, to a reasonable probability, between 1942 and 1949, and was firmly established in 1955. With respect to mesothelioma, the Plaintiffs' experts contend that a probable association of asbestos exposure and mesothelioma was generally accepted between the early to mid-1940s to the mid to late 1950s, and was firmly established by 1960.

TLVs

The Plaintiffs generally contend that TLVs were never generally accepted and that they had no government sanctions. It is further contended that the ACGIH consisted of various governmental and industrial hygienists who were or eventually would be lackeys of industry. The Plaintiffs contend that these members of the ACGIH were not "leaders" in their fields and that their TLVs were "guidelines" not standards and did not set "safe levels". The Plaintiffs further argue that the TLV merely gave a level which one should try to achieve, but did not guarantee that workers would not be harmed at the five million particles per cubic foot level. Plaintiffs also contend that the ACGIH's TLV of 5 mppcc was adopted from the Dreessen study of 1938 and, therefore, referred to 5 mppcc of total dust rather than asbestos dust. Plaintiffs and some of their experts assert that seeing 5 mppcc with the naked eye would be difficult, if not impossible. Therefore, if the dust generated in using asbestos-containing products is visible, then obviously the product was emitting more than five million particles per cubic foot. Consequently, this level of exposure was hazardous even by the standards of the ACGIH.

The Plaintiffs point out that when OSHA came into being it adopted the ACGIH recommended TLV of twelve fibers per cubic

meter, and then reduced it almost immediately to five fibers per cubic centimeter. This level was subsequently reduced to two fibers per cubic centimeter, and in July of 1986 the level was reduced to 0.2 fibers per cubic centimeter. The Plaintiffs and their experts continue to stress that this is not a "safe level", but an economically achievable level established by the United States Government. Since all Plaintiffs' State-of-the-Art witnesses are of the opinion that any exposure to any carcinogen can cause cancer, then, in their opinion, there can be no "safe level" of exposure to asbestos, a "proven" human carcinogen.

For Plaintiffs' case against particular Defendants, a good starting point would be to refer to Chapter 9 of Castleman's book, 2nd edition.

IV. OVERVIEWS OF CERTAIN ARTICLES

By

James H. Crosby

Below are a series of brief statements about articles that can be used for or against the defense in a State-of-the-Art cross or direct examination. These articles are considered to be the "bare essentials" for these purposes. Prior to 1965 there were approximately 750 articles published in the medical literature on the subject of asbestos and disease in humans. There were various other articles in medical journals, texts and trade journals dealing with the subject of asbestos and exposure in man and animal experiments. After 1965, literally thousands of articles have been written on the subject of asbestos and disease. The purpose of obtaining these articles is so an attorney trying a lawsuit will have an opportunity to have available the articles that can be helpful not only with respect to the development of medical knowledge for use in cross examination of medical experts, but also for quotes that can be beneficial to the defense with respect to the State-of-the-Art.

One is cautioned that virtually every article that contains a statement or statements favorable to one position will also contain a statement or statements that do not necessarily favor that position. The brief statements about each article are thoughts on the points that can be made with a particular article. There are other points that can be made by either side with respect to each of these articles. The purpose of the statement is to encourage the reader to research what else may be available for use by either the Plaintiffs or Defendants. These synopses are not intended to be comprehensive; each is merely a suggestion of what can be found in an article. It *is* by no means a substitute for reading the article and becoming familiar with it. It is hoped that the reader will be encouraged to find even more or better information in these and other sources.

ARTICLE 1 "Pulmonary Asbestosis" W E Cooke (1924)&(1927)

ARTICLE 2 "Report on Effects of Asbestos Dust on the Lungs and Dust Suppression in the Asbestos Industry" by E.R.A. Merewether, M.D. and C.W. Price (1930)

ARTICLE 3 "Effects of the Inhalation of Asbestos Dust on

the Lungs of Asbestos Workers" by Lanza, et al (1935)

ARTICLE 4 "Two Cases of Squamous Carcinoma of the Lung Occurring in Asbestosis" by S. Roodhouse Gloyne, M.D. (1935)

ARTICLE 5 "A Study of Asbestosis in the Asbestos Textile Industry" by Dreessen, et al (1938)

ARTICLE 6 "Asbestosis" by Sayers and Dreesen (1939)

ARTICLE 7 "A Health Survey of Pipe Covering Operations in Constructing Naval Vessels" by Fleischer, et al (1946)

ARTICLE 8 "Asbestosis and Cancer of the Lung" Editorial, JAMA (1949)

ARTICLE 9 "Survey of Some Current British and European Studies of Occupational Tumor Problems" by William E. Smith, M.D. (1952)

ARTICLE 10 "Asbestosis and Bronchogenic Carcinoma" by Isselbacher, Klaus, and Hardy (1953)

ARTICLE 11 "Mortality from Lung Cancer in Asbestos Workers" by Richard Doll (1955)

ARTICLE 12 "An Epidemiological Study of Lung Cancer in Asbestos Miners" by Braun and Truan (1958)

ARTICLE 13 "Diffuse Pleural Mesothelioma and Asbestos Exposure in the North Western Cape Province" by J.C. Wagner, C.A. Sleggs and Paul Marchand (1960)

ARTICLE 14 "Some Observations on Asbestosis" by Leathart and Sanderson (1963)

ARTICLE 15 "Asbestos Exposure and Neoplasia" by Selikoff, et al (1964)

ARTICLE 16 "Present Threshold Limit Value in the U.S.A. for Asbestos Dust: A Critique" by E.L. Schell (1965)

ARTICLE 17 "The Occurrence of Asbestosis Among Insulation Workers in the United States" by Selikoff, Chung

and Hammond (1965)

ARTICLE 18 "The Work Environment of Insulating Workers" by Balzer and Cooper (1968)

ARTICLE 19 "Diffuse Malignant Mesothelioma of the Pleura: A Review of 37 Cases" by Oels, et al (1971)

ARTICLE 20 "Effects of Low Concentrations of Asbestos" by Murphy, et al (1971)

ARTICLE 21 "Carcinogenicity of Amosite Asbestos" by Selikoff, et al (1972)

ARTICLE 22 "Mortality Experience of Insulation Workers in the United States and Canada, 1943-1976" by Irving J. Selikoff (1979)

ARTICLE 23 "Asbestos: Historical Perspective" by Lawrence Garfinkel (1984)

and

"Asbestos - An Industrial Asset with a Health Cost" by William R. Barclay, M.D. (1984)

ARTICLE 24 "Non-Asbestos-Related Malignant Mesothelioma - A Review" by Peterson, et al (1984)

ARTICLE 25 "The Origin and Basis of Threshold Limit Values" by Jeffrey M. Paull (1984)

ARTICLE 26 "Threshold Limit Values - Discussion and Thirty-Five Year Index with Recommendations" from Volume 9, Annals of the American Conference of Governmental Industrial Hygienists by Marshall E. Lanier, Ed (1984)

PULMONARY ASBESTOSIS by W. E. Cooke

Originally Dr. Cooke wrote an article in 1924 relating a case report of the same woman with fibrotic condition of the lungs. In writing that report he noted that she was the first report of a case associated with asbestos exposure, however, by 1927, when he did this post-mortum report on the same lady he had found Dr. Murray's report that was published in the Minutes of the Department Committee on Industrial Diseases in 1906.

This case report by Cooke accompanied by two other articles, one by Oliver and one by McDonald, first publishes the term "asbestosis".

The article mentions that according to Cooke his case and that of Murray's indicate that as of 1927 there were only two cases of asbestosis occurring in the two thousand year old industry. The report also refers to the manufacturing process and demonstrates that prior to dust-removal systems triggered by the 1931/1933 Regulations and Schemes, the dust conditions were so bad that you could not see each other in a room.

This case report like most case reports and other studies on the subject during the 30s through the 50s deals with the textile mills.

REPORT ON EFFECTS OF ASBESTOS DUST ON THE LUNGS AND DUST SUPPRESSION IN THE ASBESTOS INDUSTRY by E. R. A. Merewether, M. D. & C. W. Price

This 1930 report by the Medical Inspector of the Factories and C. W. Price, Engineering Inspector of the Factories, is the first "epidemiological" report conducted on the subject of asbestos and disease. It demonstrates (in the text and in the cover letter accompanying the report) that the remedy for the conditions related to medical conditions associated with asbestos exposure is "in the suppression of the dust".

The report also points out in the section "Population at Risk" that the individuals studied consisted of persons in the country exposed in their daily work to the inhalation of asbestos dust, either pure or admixed with a small proportion of cotton. That figure does not include "the considerable number of workers exposed to the influence of mixed dust of which asbestos is but one and commonly not more than twenty per cent of the mixture."

Part II of the report lists, among other things, processes giving rise to dust and methods of suppression, and among those listed are working with insulation materials, brake and clutch linings, et cetera. **It is important to note that while this information is contained in the original report published for His Majesty, it is not contained in the information published in the American Journal by the same authors.**

When this Merewether report is read in conjunction with other reports published by Merewether at approximately the same time, one can ascertain that Merewether recommended that the dust be suppressed to the level of spinners. It takes reviewing a great number of tables and articles to determine the spinners' level. Therefore, it is suggested to perhaps simply point out that it was not recommended that the dust be eliminated, but rather that it be held to the level of an individual spinning the asbestos fibers.

Obviously, the Plaintiffs use this article to demonstrate that by 1930 the medical and scientific community was fully aware of asbestosis and that it could occur in not only the textile industry, but also in the industries where the products were used.

TWO CASES OF SQUAMOUS CARCINOMA OF THE LUNG OCCURRING IN

ASBESTOSIS by S. Roodhouse Gloyne, M. D. (1935)

This is the first mention of an association with asbestosis and lung cancer. No smoking history was obtained, no reference with respect to extent of exposure is mentioned and it is pointed out that the individual involved had "asbestosis" and not merely a history of exposure to asbestos.

EFFECTS OF THE INHALATION OF ASBESTOS DUST ON THE LUNGS OF ASBESTOS WORKERS by Lanza, et al (1935)

This was a study undertaken at the request of the asbestos industry in the United States who had approached Metropolitan Life Insurance Company in 1929.

For the defense the article demonstrates that the asbestos industry in the United States was concerned and did hire reputable physicians to undertake a study to determine what risk individuals may be encountering who were employed in the textile industry's weaving asbestos. The article concluded that more studies are necessary, that the asbestosis observed in those plants had not resulted in any marked disability and that it was not yet practicable to establish standards for asbestos dust content in the air.

The Plaintiffs point out with this article that sufficient data existed to show that asbestos did result in asbestosis in individuals exposed to the dust. Plaintiffs' may try to demonstrate that one or more of its sponsors altered Dr. Lanza's original draft of the article.

A STUDY OF ASBESTOSIS IN THE ASBESTOS TEXTILE INDUSTRY by Dreessen, et al (1938)

From a defense point of view, this Surgeon General's Report is an "epidemiological" study of textile workers showing that the thinking of Dreessen and co-workers was that if dust were kept below five million particles per cubic foot (5mppcf) in an asbestos textile plant then new cases of asbestosis probably would not appear.

This level of 5mppcf was adopted by the ACGIH as its TLV in 1946 and remained the TLV until 1968 or 1970.

The Plaintiffs point out the flaws in the study in that many of the long-time employees had quit just prior to the studies being conducted. Plaintiffs insist that the TLV was 5mppcf of all dust not just pure asbestos dust.

Plaintiffs also hasten to point out that the TLV mentioned in Dreessen was tentative and that it concludes that new cases of asbestosis probably would not appear. It is their position that the study was never confirmed and that it was not a valid basis for a TLV. The bibliography to this work refers to various articles associating lung cancer with asbestosis.

The defense can point out that subsequent to Merewether's study in Great Britain, Americans undertook its study with Lanza in 1935 who concluded that a safe level had not been ascertained and that Dreessen in 1938 did set a standard of 5mppcf.

ASBESTOSIS by Sayers and Dreessen (1939)

A truncated version of the 1938 Dreessen Surgeon General's Report, where the authors conclude that it appears that if asbestos dust concentrations in the air breathed are kept below 5mppcf new cases of asbestosis will not appear.

This makes it clear that the exposure level was dealing with "asbestos dust" and not "total dust" and that the tentative nature of their language in the '38 report had been removed.

A HEALTH SURVEY OF PIPE COVERING OPERATIONS IN CONSTRUCTING NAVAL VESSELS by Fleischer, et al

This article is helpful in explains that the reasons that asbestos was used on our ships was because it was light in weight and would allow us to put more ammunition, men, food, bandages and other supplies on the ships in order to conduct a successful war effort. The authors (one of whom was Phillip Drinker of Harvard, a highly respected public health official and leading industrial hygienist) point out that the asbestos textile and pipe covering industries vary widely in dust exposure and that textile plant workers usually have a continuous exposure whereas pipe coverers rotate between shop and ship and small and large compartments with a wide variation of dust exposure. Also, in contrast to textile workers the pipe coverers' material differs markedly in their asbestos content ranging from 10-15% asbestos to 95% asbestos.

The authors conclude that in general they feel that dust counts below 5mppcf by Konimeter indicate good dust control. Further, the tables pointing out dust counts are placed in the categories of not only "total dust" but also "asbestos dust".

> Finally, the authors conclude:
>
> "Since each of the 3 cases of asbestosis had worked at asbestos pipe covering in shipyards for more than 20 years, it may be concluded that such pipe covering is not a dangerous occupation."

The Plaintiffs occasionally use this article to establish the principle that as of 1946 it was known and accepted that insulators were at risk for contracting asbestos-related disease. This is based upon the fact that the three cases of asbestosis were the only ones that had worked sufficiently long with the product to have experienced the necessary latency.

Plaintiffs are also eager to point out that the statistical data in the article does not add up and that the work is a poor epidemiological study.

ASBESTOSIS AND CANCER OF THE LUNG Editorial, JAMA (1949)

This editorial is often relied upon to demonstrate that a causal relationship between asbestos and cancer of the lung was generally accepted in the medical profession (otherwise it would not have been a JAMA editorial). Of course, from the title it is clear the article deals with "asbestosis" and not merely asbestos exposure. So, in order to contract lung cancer or any other asbestos-related disease (except skin corns) one had to contract asbestosis. Therefore, if you kept the TLV in place a worker would not contract asbestosis, hence, one would not contract any other asbestos-related disease.

SURVEY OF SOME CURRENT BRITISH AND EUROPEAN STUDIES OF OCCUPATIONAL TUMOR PROBLEMS by William E. Smith, M. D. (1952)

This article is the result of an investigative trip by Dr. Smith in 1952 who traveled to Europe and interviewed various English doctors (Gloyne, Wyers, and Merewether) to talk with them about certain occupational diseases. One of those touched on asbestosis. Smith reported that the three doctors mentioned above stated that it was the consensus that a lung tumor hazard formerly existed in the asbestos industry in Great Britain but there was no evidence to show that such a hazard continued to exist under the working conditions now prevailing.

Thus, the Regulations or Schemes implemented after the 1930 Merewether report that required dust suppression equipment to be installed in the factories were working. When implemented they applied only to the manufacturing processes and not to insulation or lagging. While the dust suppression schemes did not apply to insulation or lagging, the compensation portion of the schemes did. Therefore, an insulator with asbestosis could receive compensation, however, his work place was not subject to the dust suppression provisions.

These British doctors were of the opinion that the lung tumor hazard previously associated with asbestos was only a problem for those who had been employed under the old dusty conditions prior to the scheme and would not be a problem to those exposed after the dust levels had been lowered.

Dr. Smith attended the 1952 Saranac Symposium and, according to others who attended, stated that in his mind there was a relationship between asbestos exposure and lung cancer. Since this Symposium was not published only those who attended and survive can attempt to present this unsubstantiated hearsay in court. Of course, if the court allows hearsay upon hearsay to be presented then certain "experts" not even in grammar school in 1952 may be allowed to state that they have heard that Smith's statement at the '52 Saranac Symposium asserted a relationship between asbestos and cancer—which is contrary to what he reported in his 1952 publication.

ASBESTOSIS AND BRONCHOGENIC CARCINOMA by Isselbacher, Klaus, and Hardy (1953)

Again, it's asbestosis and bronchogenic carcinoma. For defense purposes the main quote of interest is that these leading physicians state that:

> Experience has lead to the acceptance of five million particles of **asbestos** per cubic foot of air, of small enough size to be respirable, to be the safe working concentration. (emphasis added)

Obviously these leading physicians (Dr. Hardy generally testified for claimants in asbestos-related workers' compensation hearings) accepted 5mppcf of asbestos dust to be the generally accepted safe working condition.

Insofar as the Plaintiffs are concerned the article demonstrates lung cancer and end users. Unfortunately, all were smokers.

MORTALITY FROM LUNG CANCER IN ASBESTOS WORKERS by Richard Doll (1955)

This is a study of individuals who were exposed to asbestos in the textile mills and is a study done by means of necropsy. This study did not take into consideration smoking history and is generally used by the Plaintiffs to show that it had been established as of 1955 that asbestos caused lung cancer.

For the defense the article demonstrates that of the 18 lung cancers in 15 of them there was an association with asbestosis. In all cases where there was both asbestosis and lung cancer the individual had begun work before 1923 and had worked in the industry at least nine years before the regulations (schemes) for control of dust had become effective.

Sir Richard Doll concludes that from the data it can be concluded that "lung cancer was" (*emphasis added*) a specific industrial hazard of certain asbestos workers and that the average risk among men employed for twenty or more years has been of the order of ten times that experienced by the general population. Sir Richard goes on to point out that the risk has become progressively less as the duration of employment under the old dusty conditions has decreased. Sir Richard was Her Majesty's Physician.

AN EPIDEMIOLOGICAL STUDY OF LUNG CANCER IN ASBESTOS MINERS by Braun and Truan (1958)

To determine if the American incidence of lung cancer with asbestosis would coincide with the European incidence, a study was performed by Drs. Braun and Truan. Plaintiffs attack this report for faulty data and skewing the results. They use Mancuso paper for the basis of that opinion. Dr. Mancuso contends that he provided Philip Carey with a report criticizing the Braun-Truan study.

For the defense the study is a good literature review and insofar as its epidemiological value is concerned the authors conclude:

> "Furthermore, the death rate from lung cancer in the areas contiguous to the asbestos operations is comparable to that in areas widely scattered throughout the Province of Quebec and is lower than in some urbanized areas within the Province."

The authors also conclude:

> "On the basis of what are believed to be complete and reliable data, it seems fair to conclude that the asbestos miners in the Province of Quebec do not have a significantly higher death rate from lung cancer than do comparable segments of the general population."

The literature review portion is probably its best use for counsel.

DIFFUSE PLEURAL MESOTHELIOMA AND ASBESTOS EXPOSURE IN THE NORTH WESTERN CAPE PROVINCE by J. C. Wagner, C. A. Sleggs and Paul Marchand (1960)

This article is generally put forth by the Plaintiffs as the article that establishes the relationship between mesothelioma and asbestos exposure.

For defense purposes it can be shown that the article only relates to crocidolite and that it is a case report making inquiry as to whether or not other individuals are seeing this same disease association or if it is something indigenous to the area studied by the authors.

SOME OBSERVATIONS ON ASBESTOSIS by Leathart and Sanderson (1963)

This article can be used to demonstrate that the asbestosis scheme of 1931 did not apply to laggers or insulators. The authors indicate that it should be extended to apply to them.

ASBESTOS EXPOSURE AND NEOPLASIA by Selikoff, et al (1964)

This article was not published in 1965 NYAS Annals, it was published separately in JAMA.

Plaintiffs use the article to demonstrate the association between: asbestos exposure and lung cancer, pleural and peritoneal mesothelioma, gastro-intestinal carcinoma, and the possibility of disease being contracted from environmental asbestos exposure.

For the defense, the epidemiological study that led to this publication and to the publication *The Occurrence of Asbestos among the Insulation Workers of the United States* is the only epidiological study of a large scale nature performed in the United States on insulators since the study by Fleischer and Drinker in 1946.

The 1946 Fleischer-Drinker article was not criticized (for that matter cited) in the medical and scientific literature prior to 1964. Selikoff did so in the presentation of his research on the occurrence of asbestosis in insulators as did Marr in his publication of that year.

THE OCCURRENCE OF ASBESTOSIS AMONG INSULATION WORKERS IN THE UNITED STATES by Selikoff, Churg and Hammond (1965)

Published on December 31, 1965, the Annals of the New York Academy of Sciences (Annals NYAS) contain the papers that were presented at the 1964 Conference at the Waldorf Astoria.

The purpose of the study was to determine **"if"** (*emphasis added*) insulators were at risk for contracting asbestos related disease. Furthermore, the article notes the following:

1. The TLVs were generally adhered to for insulation workers.

2. It was no longer adequate to simply refer to "asbestos workers" but now individuals who worked around or with asbestos containing products should be broken out into groups and studied to see what disease risk, if any, they were being subjected to.

3. That prior to this study there has not been an established association between lung cancer and mesothelioma in insulators.

This article does not take into account smoking histories. Also, this article, published after *Asbestos Exposure and Neoplasia* (by the same authors) indicates that the association between lung cancer and mesothelioma and asbestosis or asbestos exposure in insulation workers had not been established.

THE WORK ENVIRONMENT OF INSULATING WORKERS by Balzer and Cooper

This 1968 report demonstrates that, generally, the TLV of the ACGIH was implemented and notes that these authors are of the opinion that the TLV is too high. It does not state that the authors are of the opinion that asbestos should be banned.

In 1968 ACGIH recommended lowering the TLV from its 5mppcf, to become effective in 1970.

Clark Cooper was on the TLV Committee in 1958, 1959, 1960, and 1961.

EFFECTS OF LOW CONCENTRATIONS OF ASBESTOS by Murphy, et al (1971)

This study is a semi-follow up of one of the shipyards studied by Fleischer in the Fleischer/Drinker study of 1946. It reflects that low-level asbestos exposure, as occurs in pipe coverers in new construction, had not been considered dangerous as of 1971. The study demonstrates that the dust levels in the studied shipyard had been near the recommended TLV of 5mppcf.

The also study reports that insulators and shipyards can apparently contract asbestos-related disease, including fatal asbestosis and peritoneal mesothelioma. It also is critical (in a retrospective manner) of the Dreessen and Fleischer/Drinker studies.

Finally, the article does conclude:

> "These observations indicate that prolonged exposure to low concentrations of asbestos is hazardous, and support the lowering of the threshold-limit values.

Of course, these recommendations are consistent with the actions of the ACGIH and OSHA.

DIFFUSE MALIGNANT MESOTHELIOMA OF THE PLEURA: A REVIEW OF 37 CASES by Oels, et al (1971)

This 1971 of reports on 37 cases—3 patients had histories of definite occupational or environmental exposure to asbestos, 7 had histories of probable exposure, and 27 had histories of no known exposure. Asbestos bodies were found in the lung tissue of all three patients with definite histories of exposure, three of the seven with probable exposure, and in only five of the 27 with no exposure.

Basically, as late as 1971 there was not the strong association with asbestos exposure that is currently being touted by Plaintiffs' experts.

CARCINOGENICITY OF AMOSITE ASBESTOS by Selikoff, et al (1972)

As with all Selikoff articles particularly, and most medical and scientific articles generally, the contents cut both ways. That is true with this article.

For amosite products there is a statement that as of the time that the article was written there had been no evidence to indicate whether or not the amosite variety of asbestos is also carcinogenic. Thus, as of the time the warning requirement was issued by OSHA there had been some information available on chrysotile, croclodilte, and anthophyllite, but that with respect to amosite there was no evidence, according to an asbestos research pioneer, with respect to its ability to cause cancer in man. Many would contend that there is still not sufficient evidence with respect to chrysotile, therefore, when one is faced with a case with mixed fiber exposure this article could support a 1972 State-of-the-Art defense.

AND CANADA, 1943-1976 Irving J. Selikoff (1979)

The caveat that articles cut both ways should be stressed with this article, however, if one needs additional data to support the proposition that the TLVs were generally acknowledged this article does state:

> Few dust counts were made in insulation work until the mid-1960s. However, analysis of available data, including reconstruction of work situations and extrapolation to the past of observations made more recently, suggest that insulation workers would have been exposed to dust levels of 4-12 fibers/ml (as time weighted averages). While there might have been periods of little or no exposure, there could also have been times of peak exposures much higher than the calculated averages.

It should be remembered that the TLV Committee recommended in 1968 the lowering of the asbestos TLV for all fibers to 12 fibers per ml greater than five microns in length, or 2 million particles per cubic foot. In 1971 the ACGIH published its notice of intended changes for "mineral dust" and included a notice that asbestos was to be lowered to five fibers per milliliter greater than five microns in length. OSHA by statute adopted the 12 fibers per milliliter TLV when it came into being, however, it almost immediately adopted an emergency standard of five fibers per milliliter.

THE ORIGIN AND BASIS OF THRESHOLD LIMIT VALUES by Jeffrey M.

Paull (1984)

This article in the American Journal of Industrial Medicine (of which Irving J. Selikoff was Editor-in-Chief at the time) points out that the TLVs of the ACGIH were reasonable to rely upon and in fact were relied upon:

> "The ACGIH's role in the setting of occupational health standards, through the formulation and adoption of the TLVs, has been astonishingly influential. In fact, from about 1940 to the passage of the Occupational Safety and Health Act in 1970, this organization was the leading force in promoting U. S. industrial health standards [Calabrese, 1978]...."

and

ASBESTOS -AN INDUSTRIAL ASSET WITH A HEALTH COST by William R. Barclay, M. D. (1984)

These two editorials or articles, the first published in Ca-A Cancer Journal for Clinicians, the second in JAMA, note that it took twenty years for Selikoff's original 1964 work to be recognized by the medical community as "Landmark". Hence, is it unreasonable for it to have taken some time and for the medical and scientific community (and industry), in general, to accept these works of Dr. Selikoff. Certainly it would not be unreasonable to wait 8 to 10 years (1972-1974) before reacting by placing warnings or taking other actions with respect to certain products. Indeed, the OSHA label was not required of employers until 1972.

NON-ASBESTOS-RELATED MALIGNANT MESOTHELIOMA-A Review by Peterson, et al (1984)

This article demonstrates that there are probably other causes for mesothelioma in humans.

THRESHOLD LIMIT VALUES-DISCUSSION AND THIRTY-FIVE YEAR INDEX WITH RECOMMENDATIONS 9 Annals of the American Conference of Governmental Industrial Hygienists (Marshall E. Lanier, ed. 1984)

This volume traces the history of threshold limit values and provides information about the asbestos TLVs at various times and what individuals were on the TLV Committee.

V. EXCEEDING YOUR TLV ON TLVs THRESHOLD LIMIT VALUES

What follows is a brief chronological outline reflecting actions by the ACGIH and/or the action on U. S. Regulations relating to asbestos.

Year	Listing
1946 - 1961	The ACGIH lists asbestos as a mineral dust with a TLV of 5 mppcf.
1962 - 1967	Asbestos is listed by the ACGIH in the category of mineral dusts of a silicate form with less than 1% crystalline silica having a TLV of 5 mppcf.
1968 - 1969	The ACGIH continues to list asbestos as a silicate containing less than 1% crystalline silica with a TLV of 5 mppcf. A notice of intended change is published to indicate that the new TLV of 12 fibers per milliliter greater than 5 microns in length or 2 mppcf. Notation is made that the 12 fiber counting is to be determined by the membrane filter method at 430X phase contrast magnification. Notation is also made that the 2 mppcf counting is to be by standard impinger, light-field count technique. [In 1968 the British Occupational Hygiene Society (BOHS) proposed a standard of from 2 to 12 fibers per milliliter.] (Selikoff, 1980. Attachment AAA.) The 2 mppcf or 12 fibers per milliliter standard was adopted by the Walsh-Healey Act for Federal Contracts exceeding $10,000 in 1969. (Selikoff, 1980).
1970	The ACGIH again states that all types of asbestos that are silicates less than 1% crystalline silica has a TLV of 5 mppcf. Additionally, the ACGIH publishes another notice of intended change of the TLV to 5 fibers per milliliter greater than 5 microns in length. Notice is also provided that the

counting is to be determined by the membrane filter method at 430X magnification phase contrast illumination. There is also notification that concentrations greater than 5 fibers per milliliter - but not to exceed 10 fibers per milliliter - may be permitted for 15-minute periods each hour up to five times daily.

1971

According to historical information, the ACGIH failed to list a TLV for all types of asbestos in 1971. However, since notices of intended changes were not to become effective for 2 years from the initial listing, the TLV in 1971 should have been 5 mppcf. Although no listing was included in the 1971 listings, the notice of intended changes did state that asbestos (of all types) was to be 5 fibers per milliliter greater than 5 microns in length. This was to be determined by the membrane filter method at 400-450X magnification (4 mm objective) phrase contrast illumination. Again, the notification was included that concentrations greater than 5 fibers per milliliter, but not to exceed 10, could be permitted for 15-minute periods each hour up to 5 times daily.

The 2 mppcf or 12 fibers per milliliter standard was adopted as an interim standard for all U.S. industries covered by the Occupational Safety and Health Act(OSHA)on May 29, 1971. (Selikoff, 1980).

The EPA also proposed a national emission standard for asbestos. (Selikoff, 1980).

On December 7, 1971, an emergency standard of 5 fibers per milliliter was adopted for all U.S. industries covered by OSHA. (Selikoff, 1980).

1972

Again, historical documents of ACGIH failed to indicate the TLV for asbestos, however, it did publish the notice of intended changes for asbestos (all types) 5 fibers per milliliter greater than 5 microns in length.

Notification was also published for the first time that Footnote "Ala" may be applicable. Footnote Ala states:

"Ala: Appendix A. Carcinogens
1a. Human Carcinogens - Substances known to be occupational carcinogens with an assigned TLV. Asbestos, 5 fibers/cc > 5 um in length."

Five fibers per milliliter was adopted by OSHA (Selikoff, 1980).

(Data was published suggesting a much greater prevalence of x-ray abnormalities than originally reported to the OHS and workmen in the plant whose records had been reported to the Society Committee in 1968 and had been used as the basis for the British TLV. Selikoff, 1980.)

1973 — Again, asbestos was listed in the TLV table, however, no numeric value was assigned. However, the notice of intended change for all forms was published at 5 fiber per cc greater than 5 microns in length. References to Footnote Ala were again included. Additionally, notification was made that a more stringent TLV for crocidolite may be required.

1974 — The ACGIH continued to list asbestos as a silicate and publishes the TLV at 5 fibers per cc greater than 5 microns in length. Footnote Ala is repeated as well as the notation that a more stringent TLV for crocidolite may be required.

An EPA standard is promulgated requiring "no visible emissions" for asbestos.(Selikoff, 1980).

1975 - 1976 — The information provided by the ACGIH remained the same as for 1974. However, Appendix or Footnote Ala is now defined as: Occupational Carcinogens. 1a. Human Carcinogens. Substances, or substances associated with occupational processes, recognized to have carcinogenic or

cocarcinogenic potential, with an assigned TLV. There is the further notation associated with the asbesetos TLV contained in this footnote that "[c]igarette smoking may substantially enhance the incidence of bronchogenic carcinoma from this and others of these listed substances or processes."

NIOSH proposed a standard of 0.1 fibers per milliliter based largely on the carcinogenicity of asbestos. (Selikoff, 1980).

On July 1, 1976, the 2 fibers per milliliter level became the standard under OSHA. (Selikoff, 1980).

1977 — The ACGIH TLV and notations remain essentially the same.

1978 - 1979 — The ACGIH notes the TLV for all forms of asbestos with less than 1% quartz, to be 5 fibers per cc greater than 5 microns in length. The previous footnotes and notations remain essentially unchanged. A notice of intended change is published as follows:

Amosite . . . . . .0.5 fibers/cc, Ala
Chrysotile. . . . . .2 fibers/cc, Ala
Crocidolite . . . . .0.2 fibers/cc, Ala
Tremolite . . . . . .0.5 fibers/cc, Ala
Other forms . . . . .2 fibers/cc, Ala

1980 — The ACGIH publishes the TLV's for the various forms of asbestos as previously noted in the notice of intended changes for 1978 through 1979. Apparently, the footnote "n" for 1973 (relating to counting method) was omitted from oversight.

Footnote Ala was indicated as applicable to all types of asbestos.

1981 — The ACGIH promulgated TLV's for asbestos as follows:

Amosite . . . . .0.5 fibers > 5 um/cc, Ala
Chrysotile. . . .2 fibers > 5 um/cc, Ala

Crocidolite . . .0.2 fibers > 5 um/cc, Ala
Other forms . . .2 fibers > 5 um/cc, Ala

The major change here being that tremolite is now out of its own category and into the "Other forms" category.

1982 - 1983 The ACGIH TLV's remain essentially unchanged.

OSHA attempted to implement an emergency temporary standard (ETS) of 0.2 fibers per cc, this action was stayed by the Fifth Circuit Court of Appeals. (AIA v. OSHA, 727 F2d 415, 1984 - Attachment BBB).

1984 The ACGIH essentially republishes the TLV for 1983.

1985 - 1986 The TLV published by the ACGIH remains essentially unchanged. Notation is made that fiber counting includes fibers longer than 5 microns with an aspect ratio equal to or greater than 3:1.

OSHA adopts a TLV of 0.2 fibers per milliliter for all types of asbestos. (July, 1986).

1987 The ACGIH recommended TLVs for asbestos remain essentially unchanged from the ACGIH recommendations of 1986. However, there is a redefinition of the carcinogen designations which states as follows:

APPENDIX A

Carcinogens

The Chemical Substance Threshold Limit Values Committee classifies certain substances found in the occupational environment as either confirmed or suspected human carcinogens. The present listing of substances which have been identified as carcinogens takes two forms: those for which a TLV has been assigned and those for which environmental and exposure conditions have not

been sufficiently defined to assign a TLV. Where a TLV has been assigned, it does not necessarily imply the existence of a biological threshold; however, if exposures are controlled to this level, we would not expect to see a measurable increase in cancer incidence or mortality.

The TLV Committee considers information from the following kinds of studies to be indicators of a substance's potential to be a carcinogen in humans; epidemiology studies, toxicology studies, and, to a lesser extend, case histories. Scientific debate over the existence of biological thresholds for carcinogens is unlikely to be resolved in the near future. Because of the long latent period for many carcinogens, and for ethical reasons, it is often impossible to base timely risk-management decisions on results from human studies.

In order to recognize the qualitative differences in research results, two categories of carcinogens are designated:

A1 - Confirmed Human Carcinogens

and

A2 - Suspected Human Carcinogens

Exposures to carcinogens must be kept to a minimum. Workers exposed to A1 carcinogens without a TLV should be properly equipped to virtually eliminate all exposure to the carcinogen. For A1 carcinogens with a TLV and for A2 carcinogens, worker exposure by all routes should be carefully controlled to levels consistent with the experimental and human experience data. Please see the Documentation of the Threshold Limit Values for more complete description and derivation of these designations.

In my less than objective view, a less than objective review of the chronology of TLV, PED, MAC, etc. is contained in *Chronology*

of Asbestos Regulation in United States Workplaces by Peter A. Nowinski ASBESTOS-RELATED MALIGNANCY. (Antman & Aisner, eds. 1987). This chapter is suggested for informational purposes and primarily because the references for data relating to adoption of various TLVs are generally correct. [See also: Annals of the American Conference of Governmental Industrial Hygienists, Volume 9, July 1984, Threshold Limit Values-Discussion and Thirty-five Year Index with Recommendations, Edited by Marshall E. Lanier.]

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