



OSHA: Myths and Misconceptions

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The existence of the Occupational Safety and Health Administration can often be central to asbestos litigation, as experts will frequently provide testimony relating to the agency's regulations. These regulations have become more important in recent years, as the latest alleged asbestos exposures have occurred in the 1970s, after the enactment of OSHA. However, testimony involving OSHA should be scrutinized carefully, as OSHA regulations can reflect standards of care, particularly to the extent that employers are involved, but cannot substitute for scientific or medical research.

Numerous myths and misunderstandings have arisen regarding the importance and meaning of OSHA's regulations and pronouncements. Experts in any number of instances have testified that OSHA pronouncements support the concept that:

- very little exposure will cause asbestos related diseases
- early OSHA regulations only protect against asbestosis
- failure to monitor a work activity is negligent
- work with asbestos gaskets and packing without precautions in the 1970s violates OSHA regulations
- failure to retain early monitoring records is a violation of OSHA regulations.

Insight and, in fact, clarification of these issues can be found in a number of sources, including independent, scientific research; federal case law; and OSHA's own regulations and findings to support those regulations.

Myth #1: OSHA (and likewise the EPA) uses mathematical equations to profile accurately not only the risk of disease from asbestos exposure, but also the cause of disease, even at very low levels of exposure.

Both OSHA and the EPA use similar equations to calculate risk of disease from asbestos exposure. OSHA refers to its equations as the OSHA Nicholson model.¹ These equations assume a linear dose-response curve, meaning that risk increases proportionately to an increase in exposure.² The calculations assume no difference in potency of different types of asbestos fibers.³ The agencies rely principally upon relatively high dose exposure studies, and, from such studies, extrapolate the risk of disease at low doses of exposure.⁴ Using linear equations and extrapolation from high to low doses, the results of these equations suggest carcinogenicity at exposures approaching zero.

Under the results of such equations, there is essentially no safe threshold of exposure to asbestos. In fact, at one time OSHA adopted a policy that assumed that carcinogens had no safe threshold, but the U.S. Supreme Court rejected that policy.⁵ These rather simplistic assumptions should raise an immediate suspicion that the government models cannot be used to divine the lowest doses at which exposure may cause disease or the actual numbers of asbestos-related diseases.

Calculation of risk estimates is difficult at best. Factors which complicate the

mathematical determination of risk estimates include, but of course are not in any way limited to: (1) as the number of exposures potentially causing the particular disease increases, the calculation becomes more complex; (2) the different levels of potency of the various exposures increases the difficulty calculating the attributable risk of any particular exposure; and (3) the extent of exposures from location to location may vary despite apparent similarities.⁶ In addition, the risk from low dose exposures in these equations is not derived from low dose epidemiology but rather is extrapolated from epidemiology about the risk of exposure at much higher levels.⁷

As a result, more than one author has attempted to verify the degree to which governmental estimates of risk reflect the actual occurrence of disease among asbestos-exposed populations. Camus et al tested the model of the Environmental Protection Agency for the induction of lung cancer from asbestos exposure. The researchers compared the model with actual disease among women living in the chrysotile mining region of Canada. They found that "the EPA's risk assessment model overestimated the mortality attributable to asbestos by a factor of at least 10."⁸ Similarly, Cox et al recalculated the findings of the EPA for exposures to asbestos in the El Dorado, California, region, finding a risk profile that was only 4.1 percent of what the EPA calculated.⁹

OSHA recognizes the function of its regulations and their limitations. OSHA makes no claim that its models represent

accurate standards of the dose at which asbestos causes and does not cause disease. OSHA must base its regulations on the need to protect workers from the threat of a significant risk of harm.¹⁰ To make this determination, OSHA is not required to exercise “mathematical precision” or “anything approaching scientific certainty.”¹¹ Courts have agreed with OSHA that the basis for its regulations does not require a finding that in any way approaches scientific certainty.¹² In fact, the standard for OSHA’s findings cannot equate to the standard of proof for expert testimony in civil cases as experts in civil cases must testify to a reasonable degree of scientific certainty.¹³ One court has recently held that regulatory standards are “ineffectual” to show “substantial-factor causation.”¹⁴

OSHA explains why such proof is unnecessary. Under the applicable law, OSHA may, and in fact does, base its findings and hence its regulations “largely on policy considerations.”¹⁵ The agency recognizes that it has “substantial leeway with the kinds of assumptions it applies . . .” and that its risk assessments may involve mathematical estimates with “some inherent uncertainties.”¹⁶

OSHA’s pronouncements suggest more about the substance of its policy considerations in the interpretation of risk data. OSHA calculates “protection factors” to assure that exposures are kept “quite low (some below the level of detection).”¹⁷ Clearly, OSHA intends to meet its legislative mandate through regulations that provide a functional margin of safety to protect workers. The courts recognize this function of OSHA regulations. OSHA is “free to use conservative assumptions” and, hence, to err “on the side of overprotection rather than under protection.”¹⁸ Given these considerations, OSHA’s findings may be what it determines to be necessary to protect worker health, but such findings certainly cannot be used to provide evidence of the actual causation of asbestos-associated diseases.

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***Myth #2:* OSHA did not know in the 1970s that asbestos could under certain circumstances cause cancer and, hence, did not intend for its early asbestos regulations to protect workers against asbestos-related cancer.**

The agency itself provided the basis for this misunderstanding in the intent of early OSHA asbestos regulations. In December 1971, OSHA established a permissible exposure limit of 5 f/cc as an 8-hour time weighted average with a peak exposure limit of 10 f/cc. In June 1972, the agency left such standards unchanged but prospectively promulgated that, in July 1976, the 8-hour time weighted average of 5 f/cc would be reduced to 2 f/cc. This limit remained in effect until June 1986, when the agency reduced the 8-hour time weighted average by a factor of 10 to 0.2 f/cc.¹⁹

In October 1975, when OSHA proposed further rule making for asbestos, the agency found that there was “sufficient medical and scientific evidence . . . to warrant the designation of asbestos as a human carcinogen.” The implication was that before 1975, OSHA was not convinced that asbestos could cause cancer; however, nothing could have been further from the truth. As noted above, despite this proposed rulemaking, no new standards limiting asbestos exposure

were promulgated until 1986. Furthermore, the agency made no statement regarding when medical and scientific evidence became sufficient to classify asbestos as a human carcinogen.

In 1994, citing the above October 1975 finding, the agency argued that the June 1972 limits (5 f/cc for an 8-hour time weighted average) “were intended primarily to protect employees against asbestosis and it was hoped that they would provide some incidental degree of protection against asbestos-induced forms of cancer.”²⁰ OSHA was somehow trying to suggest that its early regulations were not intended to protect against anything other than asbestosis. In this manner OSHA attempted to provide further support for the implication in its 1975 rule making that it did not know about the carcinogenic potential of asbestos. Again, the record suggests otherwise.

Here is what the evidence demonstrates:

First, there is inconsistency in the agency’s pronouncements. If OSHA did not know until 1975 that asbestos should be classified as a human carcinogen, why should OSHA have hoped in 1972 that its regulations would provide some degree of protection against “asbestos induced forms of cancer?”

Second, the June 1972 findings provide no language to suggest that the protec-

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tions of the regulations at that time were limited solely to the prevention of asbestosis.

Third, the agency found otherwise, showing that it knew in 1972 of the carcinogenic potential of asbestos and stating that “[n]o one has disputed that exposure to asbestos of high enough intensity and long enough duration is causally related to asbestosis and cancer. The dispute is as to the determination of a specific level below which exposure is safe.”²¹ To allow the industry some time to adjust to changes in practices dealing with asbestos, the agency provided a delay in the reduction of the exposure standard from 1972 at 5 f/cc until 1976 at 2 f/cc. To allay any concerns about the adequacy of the standards, OSHA further found that “so long as the ceiling limit is complied with, no harm is reasonably expected to result from exposures during the transitional period.”²² The finding refers to “no harm,” not just the prevention of harm from asbestosis.

Fourth, the agency’s statement in 1972 that “exposure to asbestos of high enough intensity and long enough duration is causally related to . . . cancer” is consistent with the medical and scientific literature. In fact, the medical and scientific literature provides numerous pronouncements prior to 1975 on cancer risk from

asbestos depending on the type of asbestos, occupation and level and length of exposure.²³

Fifth, the same medical and scientific literature emphasizes that in 1975, when the agency said that asbestos was a human carcinogen, OSHA made no statement regarding how long the evidence had warranted such a conclusion or under what circumstances.

Sixth, Benjamin Mintz, former Director of OSHA, and current professor at Catholic University of America’s Columbus School of Law, wrote in his book, *OSHA, History, Law and Policy*, that OSHA adopted the delay in the reduction of exposures from 1972 until 1976 because the industry needed time to comply. At that time, the agency was fully aware that asbestos could cause both “asbestosis and mesothelioma,” Mintz wrote, and the standard announced in 1972 reducing exposures to 2 f/cc was necessary for worker protection but “no harm” was expected to result from exposures from 1972 through 1976.²⁴ Mintz does not attempt to make any distinction that the “harm” to be prevented was limited solely to asbestosis. Mintz, of course, wrote his book more than two years before the agency tried to rewrite history by claiming that early standards protected against asbestosis alone and against cancer only incidentally.

Of course, in 1972, OSHA had no intention of allowing employees to develop asbestosis or cancer as a result of asbestos exposure. OSHA, charged with protecting employees from “significant risk of harm,” had a legislative directive that would prevent the agency from ignoring the risk of cancer and particularly mesothelioma.

Myth #3: OSHA regulations and good industrial hygiene require application of maximal protective practices to including personal and environmental monitoring relating to all activities that could involve potential exposure to asbestos rather than the exercise of appropriate judgment.

OSHA mentions numerous precautionary and protective actions employers should take to minimize the risk of asbestos exposure. Depending on the date of the regulations, these precautions and protections include the following:

- Respirators
- Wet methods
- Protective clothing
- Environmental monitoring
- Personal monitoring
- Negative pressure enclosures
- Glove boxes²⁵

Too often there is a sense that every job and every employee that might be involved with asbestos must be monitored for a level of asbestos exposure. The provisions of OSHA have included no requirement to suspend appropriate judgment and, in fact, allow for reasonably supported judgments regarding what activities must have personal and environmental monitoring and the application of protective measures. OSHA regulations allow the employer to make a “negative exposure assessment,” i.e. exposures will not exceed PELs and excursion limits, from objective data demonstrating lack of such exposure, prior monitoring of work “closely resembling” the present

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job or process, and initial exposure monitoring for the present job or process.²⁶

The "competent person" requirement

OSHA regulations have incorporated the need to have a competent person on site during certain activities involving asbestos material in order to make judgments about the potential for exposure and the need for particular protections.²⁷ The competent person must be "one who is capable of identifying existing asbestos hazards in the workplace and selecting the appropriate control strategy . . ."²⁸ In its 1994 final rulemaking, OSHA explained that all construction site employees would "benefit from the presence of a competent person to oversee asbestos related work."²⁹

In the applicable regulations, different types of work with asbestos materials were divided into four categories (Classes I-IV) that depend largely upon the severity of risk of exposure (with Class I representing the greatest risk). *Id.* Recognizing that risk of exposure varies with the type of work; OSHA required a competent person to be continuously on-site only for Class I construction work. *Id.* For Class II and Class III work, supervision of a competent person was still required, but not continuously. Class IV work more generically required some frequent and regular inspection.³⁰

The "competent person" should evaluate the work to conclude whether no appreciable exposure is possible. For example, OSHA suggested that a person performing non-asbestos work could pass through an area contaminated with asbestos, but a competent person might conclude that the brevity of the "work" in the area presented no appreciable risk of exposure. OSHA has emphasized that the competent person must exercise judgment in the performance of an assessment about exposure confronted in the work environment. This should include an evaluation of monitoring previously done for similar type of work; however,

the assessment may not stop with monitoring but also may include issues relating to the use of precautions such as wetting and ventilation as well as supervision, training and weather.³¹

If an employer had to monitor each and every job and apply certain maximum precautions based upon the type of work, OSHA would have left no part for the exercise of judgment by the employer; rather, within certain parameters set by the different classes of work, the employer has been empowered and, in fact required, to exercise judgment to determine when monitoring is needed, where precautions must be applied and what such precautions may be.

Exemption for small scale, short duration operations

Even in the 1990s, OSHA proposed and provided a limited exemption in its construction standard for "small scale, short duration operations."³² Regulations applicable in 1989 and earlier defined the exemption by example: "pipe repair, valve replacement, installing electrical conduits, installing or removing drywall, roofing, and other general building maintenance or renovation."³³

In 1990, OSHA proposed to supplement this definition. In its notices of proposed rulemaking, OSHA provided some insight and guidance regarding the intent and application of such an exemption. Observing that "renovation, removal and demolition jobs typically involve handling substantial quantities of asbestos," OSHA implied that lesser operations could be, but should not necessarily be, classified under the exemption in all cases.³⁴ OSHA identified specifically that "small scale, short duration operations" would be exempt from the requirement for a negative pressure enclosure.³⁵ The exemption also included roofing operations and floor tile removal as well as activities for which negative pressure enclosures were "infeasible," providing some insight regarding the type of activi-

ties that may have some commonality with "small scale, short duration operations."³⁶

OSHA also proposed some specific parameters to define this exemption for small scale, short duration operations:

- Non-recurring operations
- Does not expose bystander employees
- Completed in less than a day by one person
- Completed in less than 4 hours by two people
- Is not expected to release asbestos in excess of the PEL.³⁷

The importance of the exemption for small scale, short duration operations cannot be in doubt as it excused at least the use of negative pressure enclosures. Whether the small scale, short duration operation was defined by example or defined by the more specific parameters of the 1990 notice of proposed rulemaking, OSHA never provided a bright line for what is and what is not a small scale, short duration operation. That required the exercise of judgment. In that regard, the requirement that the activity is not "expected" to release asbestos in excess of the PEL is especially notable.

Compliance with OSHA, particularly in view of the exemption for small scale, short duration operations was not a matter of monitoring every activity at every place in a facility.

OSHA regulations and the supporting promulgations mandate that an employer need not apply maximal precautions and monitor every activity and may instead exercise a degree of judgment. As OSHA standards reflected increasing restrictions and precautions for the use of asbestos, particularly compared to pre-OSHA standards, OSHA guidelines are even now instructive regarding the standard of care before OSHA. If OSHA allowed discretion and judgment in the protection of workers, certainly such judgment and discretion was appropriate before OSHA.

Myth #4: Work with asbestos gaskets and packing without precautions in the 1970s violated OSHA regulations.

OSHA regulations in the 1970s made no mention of gasket and packing work.³⁸ In 1983, as part of its rule making procedure, OSHA mentioned gasket fabrication, although not installation or removal.³⁹

That there was little or no mention earlier in OSHA regulations and its pronouncements is not surprising given the scientific and medical literature. In 1977, Whitwell et al examined a series of patients with mesothelioma. Among those patients was a plumber, age 79, with probable asbestos exposure who had worked in a shipyard from age 15 through age 31, but who had no plaques and a relatively low level of lung fiber content.⁴⁰ In the next year, in the same publication, Edge et al found a case of malignant mesothelioma in the wife of a shipyard plumber.⁴¹ Then, in 1979, Selikoff et al found radiologic abnormalities of the lung among shipyard pipefitters.⁴² In 1980 a study of pipefitters and plumbers led the authors to conclude that this occupational group was subject to excess of malignant neoplasms of the lung, esophagus and lymphatic/hematopoietic tissues. The authors of the study suggested that occupational exposures, including asbestos, may have caused these excess neoplasms, although the authors admitted that "this study cannot identify responsible agents . . ."⁴³

By the early 1980s, there were no clear conclusions that work with asbestos gaskets and packing caused disease. Most of this literature related to shipyard work, generally involving higher exposures than industrial and commercial work.⁴⁴ In addition, although pipefitters work with gaskets, they may have other exposures, asbestos or otherwise, as well as other

possible issues that may confound any conclusions.

OSHA's 1983 observation about gaskets as well as packing stated that "secondary fabrication of . . . packing and gaskets" created exposure levels approximating 2 f/cc.⁴⁵ Such a level could verge on exposures equaling the 8 hour limit of 2 f/cc that went into effect in 1976. There are a number of salient points about OSHA's pronouncement. First, OSHA made no citation to any source for this conclusion. The industries which OSHA studied to determine exposures as part of this rule making process for the basis for new regulations were manufacturing asbestos products in general, asbestos cement products, textile products, and friction products as well as insulation application and mining and milling.⁴⁶ These apparently did not include installation and removal of gaskets and packing.

In fact, most studies of gasket fabrication work produced results less than OSHA's promulgated amount of 2 f/cc. Most importantly, Madl and co-authors discovered that OSHA in 1980 collected exposure data on gasket cutters. In two samples regarding two workers, no airborne fibers were detected. For six other samples from two workers, a time weighted average exposure was determined to be 0.11 f/cc and 0.2 f/cc.⁴⁷ Such information fails to comport with OSHA's 1983 pronouncement. Other studies have found similar results substantially below the amount of 2 f/cc published by OSHA.⁴⁸ Again, this information fails to square with OSHA's claims.

Second, OSHA made no mention of gasket installation or removal in its 1983 promulgation. Even in 1990, OSHA was still considering exemptions for asbestos gasket work on pipe valves when it involved work by one worker for no more than four hours.⁴⁹ Studies of asbestos exposures from gasket installation and removal, even when the work is done dry, have shown numbers that are also less than 2 f/cc.⁵⁰

Third, as OSHA was looking at manufacturing operations, it is unlikely to have considered gasket fabrication operations by employees of a company not in the business of making and selling finished gaskets. In fact, OSHA expected secondary fabricators to use disposable respirators unless concentrations were "high" and then to use air-line respiratory equipment.⁵¹

The conclusion is that OSHA regulations did not affect work with gaskets and packing at least while the PEL was 2 f/cc.

Myth #5: Failure to retain early monitoring records is a violation of OSHA regulations and allows a plaintiff to presume that the monitoring was not accomplished.

In 1972, when OSHA first provided regulations governing the retention of records of personal and area monitoring for levels of asbestos fibers in the air, OSHA ordered the retention of such records for three years.⁵² In 1976, OSHA increased the retention period to twenty years.⁵³ A few years later, OSHA increased the retention period to thirty years.⁵⁴

There is no doubt that records created during the three-year retention period may be discarded after three years but before publication of the regulation providing the twenty year retention period without violating OSHA regulations. Furthermore, records of monitoring results created while OSHA required retention for three years need only to be retained for three years regardless of any revision of the retention period in later regulations. The retention period that applies to records is the retention period applicable when the records were created. As an example, a monitoring record created in 1975 could be discarded after three years even though OSHA changed the retention period to twenty years in 1976.

The relevant OSHA regulations require "an accurate record of all measurements . . . prescribed . . . by *this section*." The regulations also refer to "*this record*" to be maintained for the thirty year retention period.⁵⁵ The language of the regulations implies application to the record created under the particular version of the regulation applicable at the time of creation. This reading is consistent with court precedent. Regulations must be read according to "the Secretary's intent at the time of the regulation's promulgation."⁵⁶ The intent of the Secretary would have been to retain the record for only three years if the record was created during a regulation providing a three year retention period. Furthermore, if the regulation is vague as to its requirements, its application may be unconstitutional.⁵⁷ Sensibly a corporation that marks a record for retention for three years cannot reasonably be expected to find and re-mark the record every time the retention period changes.

Conclusion

These issues can become relevant in various phases of asbestos litigation. Although the list cannot be exhaustive, a few examples are instructive:

- *Compliance with OSHA standards as evidence of a lack of liability:* although compliance with OSHA standards does not preclude liability, evidence that the reasonably foreseeable use of a product, e.g. work with gaskets and packing, will not expose a plaintiff in excess of the applicable OSHA standards should be admissible evidence.⁵⁸
- *Defendants' motions in limine and objections to plaintiff's evidence:* as OSHA provides workers with a clear safety margin to protect against exposures and thereby avoid disease, plaintiff's experts should not be allowed to opine that asbestos caused plaintiff's disease because OSHA's analysis shows that very low doses cause disease.

- *Questioning of plaintiff's expert in deposition or at trial:* when plaintiff's expert argues that a defendant is negligent for failure to monitor a particular activity, he may be questioned about OSHA regulations that allow the exercise of judgment about precautions to be taken and what work to be monitored.

- *Preparation of corporate witnesses:* it is not necessarily a violation of OSHA rules that the company no longer has early monitoring records.

- *Rebuttal evidence:* plaintiffs should not be allowed to argue that OSHA never intended in the early 1970s to protect against cancer from asbestos exposure and thereby dismiss defendant's compliance with OSHA regulations in a case with alleged exposures in the early 1970s.

Government agencies have their own bureaucratic self-interests to perpetuate

and to expand the reach of their authority. Government agencies, like OSHA, will fund the "right" research that in turn supports the findings that are the basis of regulations that the agencies promulgate. The agency's regulations and pronouncements become even more complicated when interpreted with a view toward litigation with billions of dollars at stake. In this interplay any number of myths and misconceptions can arise regarding an agency's role, regulations and pronouncements.

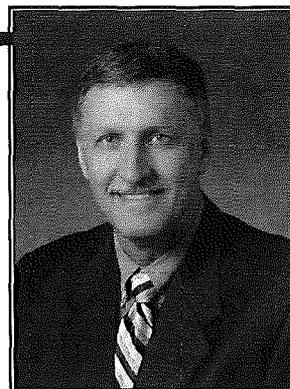
Footnotes

- ¹ Federal Register, vol. 59, no. 153: 41037 (August 10, 1994); Syracuse Research Corporation for the Agency for Toxic Substances and Disease Registry, Public Health Service, Department of Health and Human Services. *Toxicological Profile for Asbestos*. (September, 2001) Appendix D; Nicholson, W. et al. "Occupational Exposure to Asbestos: Population at Risk

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and Projected Mortality – 1980-2020.” *American Journal of Industrial Medicine*. 3: 259-311 (1982).

² Federal Register, vol. 48, no. 215: 51122, 51123 (November 4, 1983).

³ Id. at 51125.

⁴ Id. at 51120.

⁵ Federal Register, vol. 48, no. 215: 51088 (November 4, 1983); *Industrial Union Dept., AFL-CIO v. American Petroleum Institute*, 448 U.S. 607, 100 S.Ct. 2844, 65 L.Ed.2d 1010 (1980) (benzene case).

⁶ Cox, Jr., Louis Anthony et al. “Some Limitations of Aggregate Exposure Metrics.” *Risk Analysis*, vol. 27, no. 2: 439-445 (2007).

⁷ Federal Register, vol. 48, no. 215: 51120 (November 4, 1983).

⁸ Camus, Michel, et al. “Nonoccupational Exposure to Chrysotile Asbestos and the Risk of Lung Cancer.” *The New England Journal of Medicine*. vol. 338, no. 22: 1565, 1568 (1998).

⁹ Cox, *supra*.

¹⁰ Federal Register, vol. 55, no. 140: 29714 (July 20, 1990).

¹¹ Id. Federal Register, vol. 48, no. 215: 51088 (November 4, 1983).

¹² *National Maritime Safety Association v. Occupational Safety and Health Administration*, 649 F.3d 743, 750 (D.C.

Cir. 2011). *Public Citizen Health Research Group v. U.S. Department of Labor*, 557 F.3d 165, 176 (3d Cir. 2009).

¹³ *Baird v. Adeli*, 214 Ill.App.3d 47, 573 N.E.2d 279, 290, 157 Ill.Dec. 861, 872 (1991).

¹⁴ *Betz v. PneumoAbex LLC, Successor-in-Interest to Abex Corp.*, J-87-2011 (Pa.S.Ct., W.Dis., May 23, 2012) at 17, 48 (the Court accepted defendant’s argument that “prophylactic government regulations” are not proof of the causation of a disease).

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¹⁵ Federal Register, vol. 55, no. 140: 29714 (July 20, 1990).

¹⁶ Id.

¹⁷ Federal Register, vol. 59, no. 153: 41038 (August 10, 1994).

¹⁸ *National Maritime*, *supra*. *Public Citizens*, *supra*. Federal Register, vol. 48, no. 215: 51089 (November 4, 1983).

¹⁹ Federal Register, vol. 59, no. 153: 40964 (August 10, 1994).

²⁰ Id.

²¹ Federal Register, vol. 37, no. 110: 11318 (June 7, 1972).

²² Id.

²³ Doll, R. “Mortality from Lung Cancer in Asbestos Workers.” *British Journal of Industrial Medicine*. 12: 81-86 (1955) (lung cancer risk to highly exposed workers in an asbestos production plant); Wagner, C. et al. “Diffuse Pleural Mesothelioma and Asbestos Exposure in North Western Cape Province.” *British*

Journal of Industrial Medicine. 16: 260-271 (1960) (mesothelioma from crocidolite mining); Hammond, E.C. et al. “Neoplasia among Insulation Workers in the United States with Special Reference to Intra-Abdominal Neoplasia” in

Biological Effects of Asbestos. *Annals of the New York Academy of Sciences*. 132: 519-525 (1965) (lung cancer and mesothelioma risk among insulators).

²⁴ Mintz, B. *OSHA, History, Law and Policy*. 295 (Bureau of National Affairs: 1984). Personal communication with the author, November 9, 2007.

²⁵ 29 CFR sec. 1910.1001 (1998); 29 CFR sec. 1926.58 (1994); 29 CFR sec. 1926.1101 (1995).

²⁶ 29 CFR sec. 1926.1101 (1995).

²⁷ 29 CFR 1926.1101 (1995).

²⁸ Id.

²⁹ 29 CFR Parts 1910 et al and 1926 et al, "Occupational Exposure to Asbestos; Final Rule" (WAIS Document Retrieval.txt) (August 10, 1994) p. 17.

³⁰ Id; 29 CFR 1926.1101 (1995).

³¹ 29 CFR Parts 1910 et al and 1926 et al, "Occupational Exposure to Asbestos; Final Rule" (WAIS Document Retrieval.txt) (August 10, 1994) pp. 38-39.

³² Federal Register, vol. 55, no. 140: 29713 (July 20, 1990).

³³ Id. at 29718; 29 CFR 1926.58 (1989).

³⁴ Id. at 29716.

³⁵ Id. at 29717; 29 CFR 1926.58 (1989).

³⁶ Federal Register, vol. 55, no. 140: 29717 (July 20, 1990).

³⁷ Id. at 29718.

³⁸ For example, see 29 CFR 1910.93a et seq (1971) and 29 CFR 1910.1001 et seq (1977).

³⁹ Federal Register, vol. 48, no. 215: 51089 (November 4, 1983).

⁴⁰ F. Whitwell et al. "Relationship between Occupational and Asbestos-fibre Content of the Lungs in Patients with Pleural Mesothelioma, Lung Cancer and Other Diseases." *Thorax*. vol. 32, no. 4: 377, 381 (1977).

⁴¹ J.R. Edge et al. "Malignant Mesothelioma of the Pleura in Barrow-in-Furness." *Thorax*. vol. 33, no 1: 26 (1978).

⁴² Selikoff, I. et al. "Asbestos Disease in US Shipyards." *Annals of the New York Academy of Science*. vol. 330: 295, 307 (1979).

⁴³ R. Kaminski et al. "Mortality Analysis of Plumbers and Pipefitters." *Journal of Occupational Medicine*. vol. 22, no. 3: 183, 187 (March 1980) (no mention specifically of asbestosis or mesothelioma).

⁴⁴ Selikoff, I. "The Asbestos Exposure of Insulation Workmen." *Insulation Hygiene Progress Reports*. vol. 6, no. 1 at 1 (Spring 1975) (time weighted average for industrial versus maritime work was 2.7 versus 6.6 f/cc respectively for fibers over 5 microns in length).

⁴⁵ Federal Register, vol. 48, no. 215: 51089 (November 4, 1983).

⁴⁶ Id. at 51127.

⁴⁷ A. Madl et al. "Exposure to Airborne Asbestos During Removal and Installation of Gaskets and Packings: a Review of Published and Unpublished Studies." *Journal of Toxicology and Environmental Health, Part B*. vol. 10: 259, 266 (2007).

⁴⁸ R. Cheng et al. "Exposure to Asbestos from Asbestos Gaskets." *Applied Occupational Environmental Hygiene*. vol. 6, no. 7: 588, 589 (July 1991)(fabrication exposures of 0.001 to 0.49 f/cc). F. Boelter et al. "Airborne Fiber Exposure Assessment of Dry Asbestos-containing Gaskets and Packings Found in Intact Industrial and Maritime Fittings." *AIHA Journal*. vol. 63: 732, 739 (2002)(0.048 to 0.052 f/cc maximum for making gaskets with a ball peen hammer).

⁴⁹ Federal Register (1994), p. 52

⁵⁰ R. Cheng et al. "Exposure to Asbestos from Asbestos Gaskets." *Applied Occupational Environmental Hygiene*. vol.

6, no. 7: 588, 589 (July 1991) (exposures from less than 0.06 to 1.4 f/cc with the high number from use of a power sander). F. Boelter et al. "Airborne Fiber Exposure Assessment of Dry Asbestos-containing Gaskets and Packings Found in Intact Industrial and Maritime Fittings." *AIHA Journal*. vol. 63: 732, 739 (2002) (exposures from 0.004 to 0.035 f/cc maximum).

⁵¹ Id. at 51134.

⁵² 29 CFR 1910.93a (1972).

⁵³ 29 CFR sec. 1910.1001 (1976).

⁵⁴ 29 CFR sec. 1020 (1980); 29 CFR sec. 1910.1001 (1986).

⁵⁵ 29 CFR sec. 1910.1001 (1998) (emphasis added).

⁵⁶ *Ohio Cast Products, Inc. v. The Occupational Safety & Health Review Commission*, 246 F.3d 791, 794 (6th Cir. 2001).

⁵⁷ *Halliburton Energy Services v. State of Alaska, Department of Labor*, 2 P.3d 41, 50 (Alaska Superior Ct 2001).

⁵⁸ There is a myriad of holdings on the admissibility of OSHA standards and more generally on federal regulations. *McCulloch v. Fuller*, 981 F.2d 656 (2d Cir. 1992)(compliance with OSHA, although admissible, will not preclude liability); *Bailey v. V&O Press Co.*, 770 F.2d 601 (6th Cir. 1985)(admissibility of OSHA standards to refute a negligence, but not strict liability claim); *Smith v. Firestone Tire and Rubber Co.*, 755 F.2d 129 (8th Cir. 1985)(admissibility in product liability claim, particularly failure to warn); *Bammerlin v. Navistar International Transport Co.*, 30 F.3d 898 (8th Cir. 1994)(in product liability action the trial court may instruct the jury that defendant complied with federal regulations).