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Historical Perspective: The Role of Industrial Hygiene in Asbestos Products and Premises Liability Litigation

Lawrence R. Birkner, CIH, CSP, REA (CA)
Vice President and Technical Director
McIntyre, Birkner and Associates, Inc.
Thousand Oaks, California

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I. Objectives

The objectives of this paper are fourfold: (1) to provide a brief historical overview of the industrial hygiene profession, (2) to familiarize you with the unique workplace perspective of the industrial hygiene expert and the applicability of industrial hygiene to asbestos litigation, (3) to give some examples of the application of industrial hygiene principles in litigation, and (4) to review some of the ethical issues counsel and industrial hygiene experts face. This paper is designed to pique interest in the depth and breath of what the profession offers, and spark thinking about possible new and innovative ways to litigate asbestos and other toxic tort cases.

II. The History of Industrial Hygiene

The profession of industrial hygiene has a long and rich history that can be traced back to Hypocrites (470-360 BC) who observed the disease-causing properties of lead. In 1713, Bernardino Ramazzini wrote De Morbis Artificum Diatriba, the first comprehensive analysis to make the connection between occupational exposure and disease. In the 1830s, McCready (US) and Thackrah (UK) published the first modern medical texts addressing the recognition of occupational disease. With the foundation established for exposure-disease recognition, Dr. Alice Hamilton, in the early 1900s, added the dimensions of evaluation and control to the study of occupational disease—crystallizing the applied science of industrial hygiene. Dr. Hamilton's research and publications, and the British factory regulatory model provided the rationale for government's involvement and leadership in the prevention and control of occupational disease and injury in the United States.

The first modern laws regulating the work environment were promulgated by the British in 1802. These laws, which were supposed to control the workplace environment, were ineffective since they did not provide for inspection and enforcement. The British Factory Acts of 1864 and 1878 required that ventilation be used to dilute and remove air contaminants from the workplace. The 1901 British Factory Act provided for the regulation of dangerous trades and the impetus for the investigation of workplace hazards and enforcement. In 1905, the Massachusetts Health Department appointed inspectors to investigate dangerous trades, formally establishing the government's role in the area of occupational health and safety. By 1948 all states covered occupational diseases in their worker's compensation programs.

The first safety regulation was passed by Congress in 1912 to control the hazards associated with the use of white phosphorus in matches. In 1914 the US Public Health Service formed a Division of Industrial Hygiene. In 1922, Harvard established an industrial hygiene degree program, formalizing the profession. The 1936 Walsh-Healy Act (establishing safety and health requirements for contractors providing goods and services to the federal government) clearly established the federal government's role in regulating occupational health and safety.

In 1938 and 1939, respectively, the American Conference of Governmental Industrial Hygienists (ACGIH) and the American Industrial Hygiene Association (AIHA) were established. By the mid-1940s most of the states had occupational health programs and industrial hygiene staffs. In the 1950s, there was little progress in occupational health as the country was focused on post-war economic growth. The late 1960s, a period of immense social activism, spawned the era of health, safety and environmental legislation and regulation, culminating with the Occupational Safety and Health and the Environmental Protection Acts in 1970. See Table 1 for a more detailed history of the profession.

Interestingly, the history and growth of the industrial hygiene profession parallels key 20th century developments in our understanding of asbestos health effects and regulatory response. Briefly--early hints of asbestos-related disease were seen in Great Britain before 1910. These observations correspond to the early work of Alice Hamilton which defined the profession. The confirmation of a relationship between asbestos exposure and lung fibrosis in the 1930s corresponds to the formation of the major industrial hygiene professional associations. The emerging recognition of a link between asbestos and cancer between 1965 and 1975 ties to legislative developments that led to the formation of the Occupational Safety and Health Administration and the growth of the industrial hygiene field. Figure 1 shows the growth of the profession from 1940 to 1990, as measured by the membership of the world's largest industrial hygiene association. The figure also graphs the accepted asbestos exposure limits for the same period.

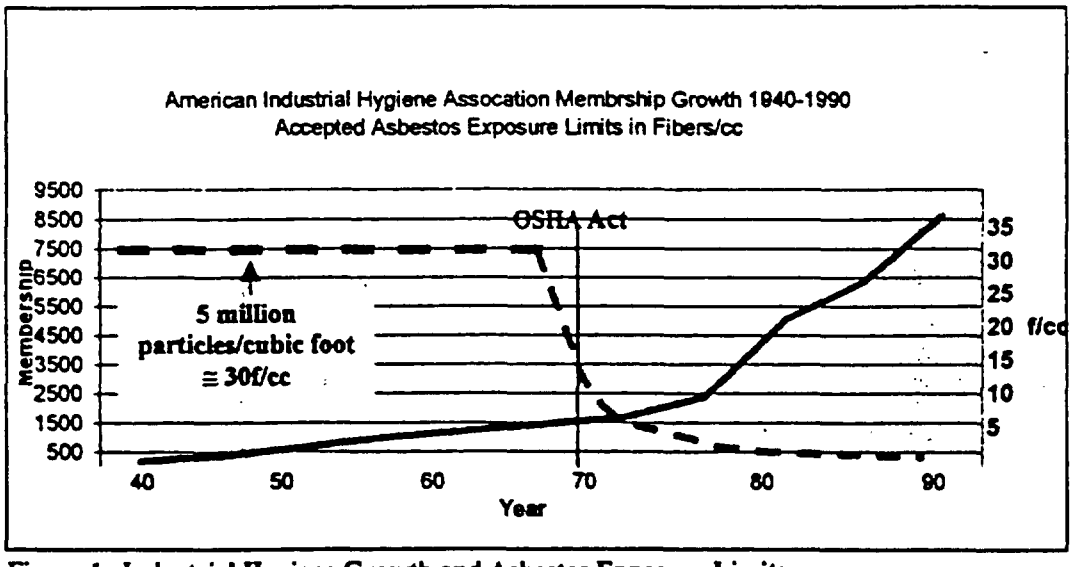

Figure 1--Industrial Hygiene Growth and Asbestos Exposure Limits

III. The Asbestos Historical Perspective

A brief history of asbestos and its uses will help us understand the magnitude of the asbestos challenge. The unique properties of asbestos, a generic name for a family of fibrous minerals, have been known since ancient times. Roman historians wrote about asbestos; Plutarch describes asbestos lamp wicks;

Hereodotus mentioned the use of asbestos cremation cloths to salvage the ashes of the dead; and Pliny described the use of an animal bladder to protect slaves from asbestos dust in an early reference to occupational disease and respiratory protection.

In modern times, practical uses of asbestos were first demonstrated in Quebec during the 1850s, by Henry Ward Johns. He developed a fire resistant composite roofing material by mixing asbestos with burlap, pitch and paper. Johns also formulated gasket material and pipe and boiler insulation. It is ironic that his death certificate indicates that he died of "dust- phthisis pneuomonitis." Following his death, Johns's company was purchased by C. B. Manville to form the Johns-Manville Company.

Called the "Magic Mineral, the use of asbestos grew throughout the first half of the 20th Century. Its strength, chemical and temperature resistance and its abundance led to its use in a wide variety of products. Asbestos was considered a strategic mineral in WWII and its production was controlled by the federal government. The government's massive war shipbuilding effort relied on asbestos products to insulate pipes, boilers; and later a sprayed-on material was also used to fireproof ship structures. Following the war, it was heavily used in a sprayed-on steel fire protection system for multi-story buildings. In 1970, asbestos fireproofing was reportedly used in over half of all multi-story buildings.

In the early 1970s, the use of asbestos began to decline following the publication of various health studies by Dr. Irving Selikoff and his associates at the Mount Sinai School of Medicine in New York. In 1970, Philadelphia enacted the first ban on asbestos fireproofing products, and the EPA issued a nationwide ban on sprayed-on fireproofing in 1973. Since 1974, the peak year for US asbestos consumption, sales have declined from 800,000 metric tons to 30,000 metric tons in 1994.

At the time of its formation in 1970, the regulation of asbestos was at the very top of OSHA's agenda. The agency's emergency temporary asbestos standard of 1971 began the consolidation of over 40 years of science and was certainly a defining moment in the protection of thousands of workers with exposure to asbestos. Today, asbestos is one of the most regulated materials on earth.

Table 1
Historical Events in Occupational Health and Safety

1,000,000 BC	Australopithecus used stones as tools and weapons. Flint knappers suffered cuts and eye injuries; bison hunters contracted anthrax.
10,000 BC	Neolithic man began food-producing economy and the urban revolution in Mesopotamia. At end of Stone Age, grinding of stone, horn, bone, and ivory tools with sandstone; pottery making, linen weaving. Beginning of the history of occupations.
5000 BC	Copper and Bronze Age—metal workers released from food production. Metallurgy—the first specialized craft.
370 BC	Hippocrates dealt with the health of citizens, not workers, but did identify lead poisoning in miners and metallurgists.
50 AD	Plinius Secundus (Pliny the Elder) identified use of animal bladders intended to prevent inhalation of dust and lead fume.
200 AD	Galen visited a copper mine, but his discussions on public health did not include workers' disease.
Middle Ages	No documented contributions to the study of occupational diseases.
1473	Ellenbog recognized that the vapors of some metals were dangerous and described the symptoms of industrial poisoning from lead and mercury with suggested preventive measures.
1500	In *De Re Metallica* (1556), Georgius Agricola described every facet of mining, smelting, and refining, noting prevalent diseases and accidents, and means of prevention including the need for ventilation. Paracelsus (1567) described respiratory diseases among miners with an excellent description of mercury poisoning. Remembered as the father of toxicology. "All substances are poisons . . . the right dose differentiates a poison and a remedy."
1665	Workday for mercury miners at Idria shortened.
1700	Bernardino Ramazzini, "father of occupational medicine," published *De Morbis Artificum Diatriba*. (Diseases of Workers) and examined occupational diseases and "cautions." He introduced the question, "Of what trade are you?"
1775	Percival Pott described occupational cancer among English chimney sweeps, identifying soot and the lack of hygiene measures as a cause of scrotal cancer. The result was the Chimney-Sweeps Act of 1788.
1830	Charles Thackrah authored the first book on occupational diseases to be published in England. His views on disease and prevention helped stimulate factory and health legislation. Medical inspection and compensation were established in 1897.
1900s	Dr. Alice Hamilton investigated many dangerous occupations and had tremendous influence on early regulation of occupational hazards in the United States. In 1919 she became the first woman faculty member at Harvard University and wrote *Exploring the Dangerous Trades*.

A portrait of Paracelsus (1567) who is remembered as the father of toxicology.

Table 1–History of Industrial Hygiene

Table 1 (continued) —
Historical Events in Occupational Health and Safety

1902–1911	Federal and then state (Washington) legislation covering workers' compensation. By 1948 all states covered occupational diseases. First survey in the United States of the extent of occupational disease conducted by the Illinois Occupational Disease Commission. Massachusetts appointed health inspectors to evaluate dangers of occupations.
1910	First national conference on industrial diseases in the United States.
1912	U.S. Congress levied prohibitive tax on the use of white phosphorus in making matches.
1913	National Safety Council organized. New York and Ohio established first state industrial hygiene agencies.
1914	USPHS organized a Division of Industrial Hygiene and Sanitation. American Public Health Association organized section on industrial hygiene.
1916	American Association of Industrial Physicians and Surgeons formed. American Medical Association held first symposium on industrial hygiene and medicine.
1922	Harvard established industrial hygiene degree program.
1928–1932	Bureau of Mines conducted toxicological research on solvents, vapors, and gases.
1936	Walsh-Healy Act required companies supplying goods to government to maintain safe and healthful workplaces.
1938	National (later American) Conference of Governmental Industrial Hygienists formed.
1939	American Industrial Hygiene Association organized. American Standards Association and ACGIH prepared first list (maximum allowable concentrations) of standards for chemical exposures in industry.
1941–1945	Expanded industrial hygiene programs in states.
1941	Bureau of Mines authorized to inspect mines.
1960	American Board of Industrial Hygiene organized by AIHA and ACGIH.
1966	Metal and Nonmetallic Mine Safety Act.
1968	Professional Code of Ethics drafted by AAIH. Code adopted by all four industrial hygiene associations by 1981.
1969	Coal Mine Health and Safety Act.
1970	Occupational Safety and Health Act.
1977	Federal Mine Safety and Health Act.
1992–present	Efforts to significantly amend OSHAct.
1995	Revised Professional Code of Ethics adopted by all four industrial hygiene associations.

Table 1 (Continued) is reprinted, with permission, from *The Occupational Environment—Its Evaluation and Control*, Chapter 1 The History and Philosophy of Industrial Hygiene, V. E. Rose, AIHA Press, 1997.

IV. Fundamental Definitions

There is much confusion and misuse of a number of important concepts in the field of industrial hygiene and occupational health. Some of the difficult concepts include:

- ***Dose*** is the amount of a substance or energy actually absorbed per unit of volume or weight of an individual or organ.

- ***Concentration*** is the amount of a given substance in a stated unit of measure. For example, the unit volume or weight of a chemical per volume of air (part per million parts of air (ppm), milligrams per cubic meter of air (mg/M^3). For asbestos it is generally a fiber count per cubic centemeter of air (f/cc)).

- ***Exposure*** is the state of being exposed to a concentration or magnitude of a chemical or physical agent. It is important to note that exposure is not the same as dose.

- ***Hazard*** is thought of as a situation that is capable of causing harm. Thus the greater the risk, the higher the likelihood that hazard will cause harm.

- ***Risk*** is the probability and magnitude of harm. For chemical and mineral exposures, it is defined as a function of toxicity and exposure.

- ***Toxicity*** is a relative property of a substance and refers to the harmful effect (e.g., eye irritation, nerve damage, tissue fibrosis, or cancer, etc.) on some biologic mechanism and the condition under which this effect takes place (e.g., inhalation, ingestion, dose, etc.).

- ***Safe*** is thought of as being free from unacceptable risk, or conversely, acceptable risk is thought of as being safe. What is safe is a perception of the level of risk that exists in a given situation and a willingness to accept that risk by an individual or society.

V. The Processes of the Profession

The profession is built on four processes: *first*, the **anticipation** of potential exposures and their possible consequences; *second*, the **recognition** of existing exposures and their potential health outcomes; *third*, the quantitative and qualitative **evaluation** of the work environment and the *fourth*, design of workplace environmental **control** strategies. Using basic sciences such as chemistry, biology, and physics; applied sciences such as toxicology, epidemiology, medicine and engineering, and an understanding of business operations, the industrial hygienist ultimately seeks to to prevent occupationally related disease.

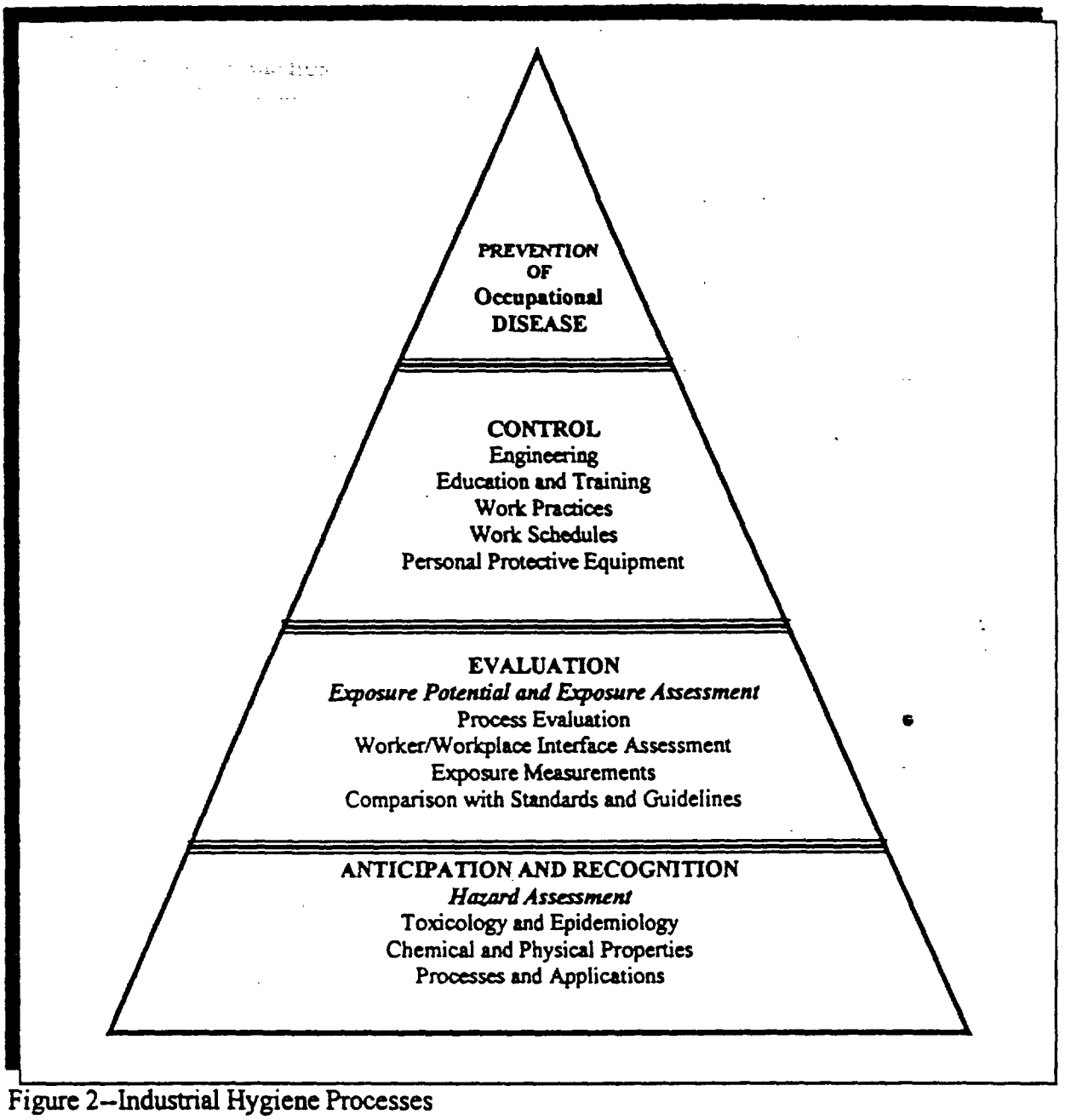

Figure 2--Industrial Hygiene Processes

V.1 Anticipation and Recognition

The first step in addressing a potential workplace health risk is the recognition that a potential exposure to a hazard exists. With the complexity of the work environment, anticipation and recognition of workplace exposures are the most difficult parts of the industrial hygiene process. They require a wide range of experience and knowledge—from staying abreast of changing developments in science, engineering and medicine—to developing an understanding of manufacturing, construction and service operations. Most important, however, is developing a firm grasp of the worker-work environment interface.

It is essential to have a strong knowledge of chemistry, physics, biology and toxicology and yet communicate to managers and workers in non-technical and non-threatening terms. To properly anticipate and recognize exposure to workplace hazards, the industrial hygienist and occupational health physician, must have open lines of communication with research and development organizations, operating management and the worker. Only in the last two decades, however, has the business-team concept in occupational health solidified. Anticipation, which requires a team approach, was only adopted as part of the recognition process in the 1980s, and to date, little has been written about it. Figure 3 depicts the process.

Anticipation of Future Exposures	Hazard Assessment	Recognition of Existing Exposures
Track developments in technology and identify the potential exposures associated with the technology. Determine how these technologies will be applied.	Track developments in medicine and toxicology to assess agent hazards.	Understand current technology, manufacturing processes, and exposures associated with them.
Determine what substances or physical agents are used in the workplace in question and assess the physical, chemical and health hazards		
Influence the planning and design to help assure processes and work practices are affected to control exposures to employees.	Assess the nature of health hazards.	Conduct an initial walkthrough survey of the work environment to develop an understanding of the worker—workplace interface and the nature of potential exposures.
Conduct a qualitative risk assessment, combining knowledge of the hazards and estimating potential exposures to the identified hazards to help determine the nature and extent of the evaluation processes.		

Figure 3. Simplified Anticipation and Recognition Process

V.2 Evaluation

Evaluation involves the examination and judgement of the amount, degree, and significance of health hazards in the work environment. The process builds on knowledge gained in the anticipation and recognition process and involves a qualitative and quantitative assessment of the environment. It requires building an understanding of the details of the work process--materials and equipment used, exposure controls, work schedules, production rates, work practices, as well

as taking measurements of exposures in the work environment. Figure 4 summarizes the evaluation process.

Phase	Action	Outcome
1. Preliminary	• Review Anticipation and Recognition Data	• Evaluation strategy
	Determine process • raw materials • intermediates • products • bi-products • wastes • physical agents	• List of agents with potential exposure significance
2. Walkthrough Survey	Determine process: • steps • equipment used • work practices (correct and actual) • production rates • raw material consumption rate • waste generation rates • Identify exposure control methods and strategies that are in place	• List of jobs and tasks with potential exposures • Estimate of process exposure variability • Qualitative description of workplace/worker interface and exposure potential • Exposure control strategies
	• Qualitative Risk Assessment	• Areas of potential significant risk potential • List of jobs and tasks that provide a representative assessment of workplace exposures
3. Measurements	• Develop a measurement (sampling) protocol defining, how many, when, where, and how samples are to be taken.	• A sampling protocol that meets the level of scientific validity required by regulatio and internal requirements
	• Conduct exposure measurements and workplace observations • Analyze samples by required laboratory methods • Calculate exposures	• Raw data • Analyzed exposures
4. Evaluation and Recommendations	• Place exposures in context of all operational and qualitative data collected, guidelines and standards.	• Conclusions about exposures • Recommendations • Report to management
Control		

Figure 4. The Evaluation Process

V.3 Control

Once the environment has been evaluated and the nature and degree of exposure is characterized, decisions about the necessity for and type of control strategies are made. The fundamental assumptions that underpin the control of recognized workplace hazards are:

- All hazards can be controlled to some degree by some method.
- There are alternative strategies to control each hazard.
- Multiple controls may be required to achieve the desired mitigation level.
- Some controls are more cost effective than others.
- Control strategies may not be able to completely control the hazard.

The primary objective of any set of control strategies is to interrupt the path between the source of the recognized, problematic exposure and the worker. Figure 5 depicts this concept and presents a number of general control strategies.

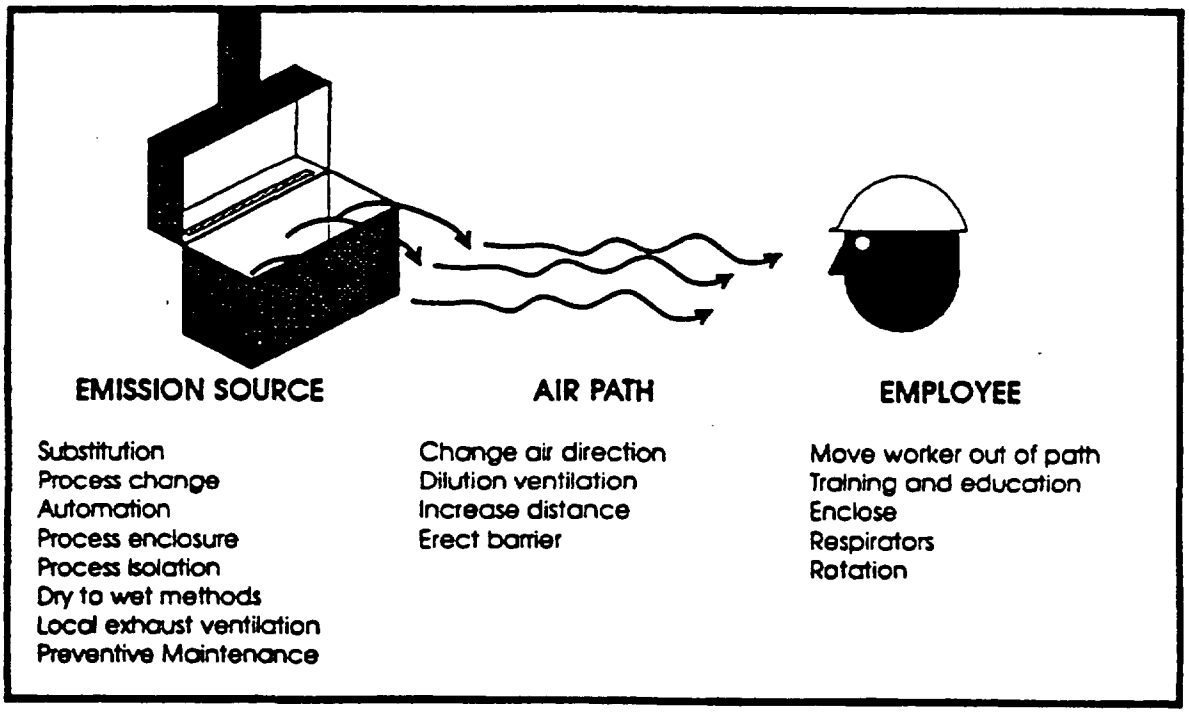

Figure 5. –General control strategies at the source, path and the worker– reprinted, with permission, *from The Occupational Environment—Its Evaluation and Control*, Chapter 31, General Methods for the Control of Airborne Hazards, D. Jeff Burton, AIHA Press, 1997.

The hierarchy of controls generally accepted by the industrial hygiene profession and regulatory agencies requires that the exposure be designed or engineered out of the process. If this is not possible, then other strategies that include employee scheduling (administrative controls), work practice design and training, and use of personal protective equipment may be employed. The hierarchy for addressing airborne hazards is listed in Table 2.

Method	Strategy
Engineering	Elimination Substitution Isolation Enclosure Ventilation Process change Product change Dust suppression Preventative maintenance
Administrative/Management	Program management Housekeeping Sanitation Work practices Education and training Labeling and warning systems Environmental monitoring Waste disposal practices Rotation of employees Medical controls
Personnel Protective Equipment	Respiratory protection Other protective clothing/equipment

Table 2—Hierarchy of exposure control

VI. The Role of the Industrial Hygienist in Asbestos Management

In order to understand the role the industrial hygiene expert may play in litigation, it is important to comprehend his or her role in the asbestos management process.

Since the early days of the profession, the industrial hygienist has played a role in the management of dusty materials. As knowledge about the relationship between asbestos exposure and lung fibrosis emerged in the 1930s, and the connection between asbestos exposure and lung cancer and mesothelioma reached consensus between 1965 and 1975, the position of the industrial hygienist has grown in significance. The role industrial hygienists play include:

- As the health professional, the industrial hygienist understands the health risks of asbestos and can relate the risk of exposure to employees, managers, engineers, regulators and jurors.

- As an air-monitoring specialist, the industrial hygienist has a solid understanding of sampling and analytical techniques and can ensure that environmental measurements are meaningful and interpreted accurately to assess the levels of asbestos in the work environment.

- As an engineer, the industrial hygienist has an understanding of the practical issues involved in contamination control, work area isolation, work practices, and in the use of personal protective equipment.

- As a teacher, the industrial hygienist is routinely called upon to communicate technical and health risk information to lay persons, and to instruct workers in safe work procedures and management of resources required for assuring control.

- As a project manager, the industrial hygienist has experience in working with a team to achieve specific operational goals and to coordinate exposure control.

VII. Retaining an Industrial Hygienist for Asbestos Litigation

Now that we know what an industrial hygienist does, we can focus on the role the IH expert can play in developing and litigating product and premises liability cases. It is important to recognize that, unlike the legal or medical profession, there is no well defined educational route to becoming an industrial hygienist. Hygienists generally start with a strong science base in chemistry, physics, biology or mathematics or a solid foundation in the applied disciplines of engineering toxicology or epidemiology. With this background many people practicing today have sought advanced degrees in industrial hygiene. There are only a handful of schools that offer undergraduate degrees in industrial hygiene, primarily because it is believed that a sufficient science base cannot be developed when compressed with the applied industrial hygiene coursework. The American Board of Industrial Hygiene (ABIH) sets the standards for education and experience and board certifies industrial hygienists that meet its level of experience requirements. The Accreditation Board of Engineering and Technology (ABET) accredits university industrial hygiene programs.

The profession is focused on bringing good science and engineering to bear on preventing occupational disease by controlling exposures, thus reducing risk. This mission requires that the industrial hygienist be able integrate and apply data from the basic sciences, medicine, toxicology, epidemiology, engineering, operations and management. The industrial hygienist is, effectively, the integrator and conduit of this information into the workplace and is key in managing the multidimensional interface between the workplace and the employee:

When retaining an industrial hygiene expert to provide consulting services or expert witness testimony in asbestos litigation, counsel should determine:

- The education of the industrial hygienist
- Total years of experience
- Board certification in industrial hygiene
- Years and type of asbestos experience
  -product manufacturing
  -research and development
  -construction
  -mining and milling
  -building operations and maintenance
  -plant operations and maintenance
  -automotive, etc.

- Litigation experience and potential conflicts
- Historical knowledge
  -medical, epidemiologic, toxicology
  -regulatory
  -non-regulatory standards
  -warnings and labeling
  -product application
- Communications skills
- Authorship of books, chapters and articles addressing asbestos or related areas
- Research addressing asbestos or related areas
- Creativity and innovativness

Selected properly, the industrial hygiene expert should be able to review the facts in the case and help to formulate creative and innovative scientific and technical strategies for litigation. They should be able formulate opinions based on exposure samples, available information about operating conditions, procedures, policies, depositions, interviews, etc.

Given adequate information, they should be able to reconstruct a theoretical model of historical working conditions and provide exposure estimates with a reasonable degree of scientific certainty.

VIII. The Industrial Hygienist as an Asbestos Expert

Industrial hygienists with their intimate knowledge of the workplace, can play a key role in helping legal counsel in explain complex issues beyond those familiar to the ordinary witnesses, to judges and jurors. Specifically, an industrial hygienist can help develop litigation in the following areas:

- Explaining the concepts of hazard, exposure, dose, risk and safety.
- Analyzing and explaining the nature and degree of workplace exposure
- Helping to define what is safe.
- Analyzing and explaining the effectiveness of company industrial hygiene programs, policies, procedures, and their evolution over time.
- Explaining compliance and regulatory enforcement issues.
- Explaining historical "state-of-the-art" issues with respect to regulations, exposure standards, work practices, engineering controls, warnings and labeling, etc.
- Analyzing and explaining work practices, their resultant exposures to potential hazards, and the magnitude of subsequent risks.

The advantage the industrial hygiene expert has is the broad base of knowledge and expertise used in occupational health. While the industrial hygienist cannot provide medical, toxicology, or epidemiologic opinions or judgements, he or she can advise

a jury how this information has been used in making judgements about workplace protection or how the exposure limits or recommended guidelines have changed as medical science grew more knowledgeable. Subsequently the IH can explain how workplace conditions, labeling, warnings, use of personal protective equipment and required medical evaluations evolved as the knowledge in the field grew. Since the IH has frequently been the only information conduit of occupational health data to and from the worker and management, they are qualified and well equipped to explain these issues to a jury. More importantly, they can discuss the concepts in terms that can be understood in the courtroom. Below are a number of examples of where the industrial hygienist can be used in asbestos premises and product liability litigation.

IX. Using the Industrial Hygiene Expert--Examples

1. **Product Applications**—The industrial hygienist can discuss the asbestos content of products, their application and exposure potential. They can review the use of the product in the context of state-of-the-art knowledge of health hazards, regulatory standards, and control technology. The expert should be able to provide analogies and examples to help simplify the complexities of key points of science and engineering. When exposure data is available, the expert should be able to use it to provide an assessment of the exposures and to place them in the appropriate historical scientific and regulatory context.

2. **Premises Exposure and Risk**—The industrial hygiene expert can evaluate the exposure to building occupants and maintenance workers associated with installed building materials and their components, such as abestos. They can review and discuss the condition of installed materials. Based on existing medical and epidemioloical information, the expert can aid in the estimation of risk associated with building occupation and compare it to the risk of breathing outdoor air.

3. **Explaining Scientific Principles**—The expert will be able to explain concepts like dose-response, exposure, hazard and safety to a jury using ordinary common-experience examples. The expert can take these principles and demonstrate how they relate to the case at hand. For example, the IH can demonstrate, how and why different work practices with asbestos containing material can yield different levels of exposure.

4. **Scientific and Regulatory History**
   When addressing issues such as asbestos exposures, the expert familiar with the literature and the changing regulatory environment can discuss asbestos levels found in the work environment, exposure control methods, and the accepted exposure limits for the time period in which the exposures in question occurred. The contribution of workplace exposures to cumulative-life time exposures and the risks that were understood in the exposure timeframe can also be addresed. Table 3 is an example of a graphic that an industrial hygienist might use to help a jury understand the changing nature of the science and the regulations that developed in response to this knowledge.

Year	<1969	1969	1971	1972–1973** (12/7/71)	1976	1986	1994
Accepted Safe Exposure Limit f/cc	5mppcf est. 30f/cc	12	12/~~10~~	5	2	0.2	0.1
Accepted Safe Cumulative Exposure for 50 year working life in f/cc-years	1500	600	600/500	250	100	10	5
Standard formulated to prevent	Asbestosis	Asbestosis	Asbestosis	Cancer	Cancer	Cancer	Cancer
Authoritative Body	USPHS ACGIH	Walsh-Healy ACGIH*	OSHA	OSHA ACGIH	OSHA ACGIH	OSHA ACGIH	OSHA ACGIH

*12f/cc proposed by ACGIH—never formally adopted
**Adopted by ACGIH in 1973

Table 3. Example of an exhibit to explain the change in scientific and regulatory knowledge

5. **Explaining Exposure Monitoring**—One of the central activities conducted by industrial hygienists is exposure evaluation. When it is necessary for a jury to understand the basic concepts of exposure measurement and analysis, the industrial hygiene expert can explain collection and analytic methods, and can place the results in context. When it is necessary to evaluate a set of samples that has been placed into evidence, the expert can discuss the results and their meaning in terms of past and current standards. The hygienist may also be able to draw conclusins about the risk, if any, associated with the exposure data.

5—**Authoritative Standards**—Regulations are difficult to understand, even for those who work with them daily. The expert can help a jury unravel the motivation and meaning of standards. For example, authoritative exposure limits for asbestos have been established by the American Conference of Governmental Industrial Hygienists (ACGIH) and the Occupational Safety and Health Administration. The IH expert can help explain the underlying philosophy, and science used to establish safe exposure limits. For example (see table 4):

Authoritative Body	Underlying Standard Setting Philosophy
ACGIH	"...airborne concentrations of substances...under which it is believed that nearly all workers may be repeatedly exposed day after day without adverse health effects."
OSHA Standards	... the standard which most adequately assures, to the extent feasible, on the basis of the best available evidence, that no employee will suffer material impairment of health or functional capacity even if such employee has regular exposure to the hazard dealt with by the standard for the period of his working life. **(OSHA Act (Pub. Law 91-596)) Sec.6(b)(5)).**

Table 4—Standard Setting Philosophy

The industrial hygienist can also explain how these standards have been applied by the occupational health professions. The expert can review specific details of these regulations including the preamble, exposure controls, use of respirators, medical surveillance, and exposure monitoring. In the period of time prior to federal regulatory standards, the expert can elaborate on generally accepted state requirements or others accepted by the profession.

X. Ethics

The role of the industrial hygiene expert is to provide information based on expertise, and to offer opinions that, to the best of his or her knowledge, arise from objective considerations of all the variables involved. The industrial hygiene expert should be able to state that opinion no matter whether retained by counsel for the plaintiff or defense. Opinions, given the same set of facts, will be the same for both. It is important that industrial hygiene experts maintain their objectivity and integrity and not view the case through the attorney's lens, but provide opinions strictly on the facts as presented.

The industrial hygiene expert must view the entire set of evidence in the case and should not make decisions based only on counsel's selection of documents. The industrial hygienist must be given all documents, depositions, data, product information, site tours, and anything else that is necessary and reasonable to form an opinion.

It is also important for the industrial hygienist to recognize the boundaries of his or her knowledge and expertise and to make sure that counsel is fully apprised of those boundaries. The industrial hygiene expert must not be persuaded to go beyond his or her technical limits. The profession's code of ethics appears in Figure 6, and it should be used as a tool to guide the relationship between the industrial hygiene expert and legal counsel.

XI. Conclusion

Workplace health issues are complex, involving the evaluation of variable work environments, multiple exposures, changing scientific and engineering knowledge, altering demographics, and new and revised regulations. Industrial hygiene provides

a broad, multi-dimensional perspective that integrates the basic sciences, with the applied sciences of medicine, toxicology, epidemiology, and engineering. The industrial hygiene approach defined in this paper will give counsel, judges and jurors a framework in which to see and grasp premises and product litigation in a manner that will aid in their fair and effective case adjudication.

Code of Ethics for the Practice of Industrial Hygiene

Objective

These canons provide standards of ethical conduct for Industrial Hygienists as they practice their profession and exercise their primary mission, to protect the health and well-being of working people and the public from chemical, microbiological, and physical health hazards present at, or emanating from, the workplace.

Canons of ethical conduct

CANON 1

Industrial Hygienists shall practice their profession following recognized scientific principles with the realization that the lives, health, and well-being of people may depend upon their professional judgment and that they are obligated to protect the health and well-being of people.

INTERPRETIVE GUIDELINES

- Industrial Hygienists should base their professional opinions, judgments, interpretations of findings, and recommendations upon recognized scientific principles and practices which preserve and protect the health and well-being of people.
- Industrial Hygienists shall not distort, alter, or hide facts in rendering professional opinions or recommendations.
- Industrial Hygienists shall not knowingly make statements that misrepresent or omit facts.

CANON 2

Industrial Hygienists shall counsel affected parties factually regarding potential health risks and precautions necessary to avoid adverse health effects.

INTERPRETIVE GUIDELINES

- Industrial Hygienists should obtain information regarding potential health risks from reliable sources.
- Industrial Hygienists should review the pertinent, readily available information to factually inform the affected parties.
- Industrial Hygienists should initiate appropriate measures to see that the health risks are effectively communicated to the affected parties.
- Parties may include management, clients, employees, contractor employees, or others, dependent on circumstances at the time.

CANON 3

Industrial Hygienists shall keep confidential personal and business information obtained during the exercise of industrial hygiene activities, except when required by law or overriding health and safety considerations.

INTERPRETIVE GUIDELINES

- Industrial Hygienists should report and communicate information which is necessary to protect the health and safety of workers and the community.
- If their professional judgment is overruled under circumstances where the health and lives of people are endangered, Industrial Hygienists shall notify their employer, client, or other such authority, as may be appropriate.
- Industrial Hygienists should release confidential personal or business information only with the information owner's express authorization, except when there is a duty to disclose information as required by law or regulation.

CANON 4

Industrial Hygienists shall avoid circumstances where a compromise of professional judgment or conflict of interest may arise.

INTERPRETIVE GUIDELINES

- Industrial Hygienists should promptly disclose known or potential conflicts of interest to parties that may be affected.
- Industrial Hygienists shall not solicit or accept financial or other valuable consideration from any party, directly or indirectly, which is intended to influence professional judgment.
- Industrial Hygienists shall not offer any substantial gift, or other valuable consideration, in order to secure work.
- Industrial Hygienists should advise their clients or employer when they initially believe a project to improve industrial hygiene conditions will not be successful.
- Industrial Hygienists should not accept work that negatively impacts the ability to fulfill existing commitments.
- In the event that this Code of Ethics appears to conflict with another professional code to which Industrial Hygienists are bound, they will resolve the conflict in the manner that protects the health of affected parties.

CANON 5

Industrial Hygienists shall perform services only in the areas of their competence.

INTERPRETIVE GUIDELINES

- Industrial Hygienists should undertake to perform services only when qualified by education, training, or experience in the specific technical fields involved, unless sufficient assistance is provided by qualified associates, consultants, or employees.
- Industrial Hygienists shall obtain appropriate certifications, registrations, and/or licenses as required by federal, state, and/or local regulatory agencies prior to providing industrial hygiene services, where such credentials are required.
- Industrial Hygienists shall affix or authorize the use of their seal, stamp, or signature only when the document is prepared by the Industrial Hygienist or someone under their direction and control.

CANON 6

Industrial Hygienists shall act responsibly to uphold the integrity of the profession.

INTERPRETIVE GUIDELINES

- Industrial Hygienists shall avoid conduct or practice which is likely to discredit the profession or deceive the public.
- Industrial Hygienists shall not permit use of their name or firm name by any person or firm which they have reason to believe is engaging in fraudulent or dishonest industrial hygiene practices.
- Industrial Hygienists shall not use statements in advertising their expertise or services containing a material misrepresentation of fact or omitting a material fact necessary to keep statements from being misleading.
- Industrial Hygienists shall not knowingly permit their employees, employers, or others to misrepresent the individuals' professional background, expertise, or services which are misrepresentations of fact.
- Industrial Hygienists shall not misrepresent their professional education, experience, or credentials.

Figure 6.— The joint Code of Ethics for the Practice of Industrial Hygiene endorsed by the AIHA, the ABIH, the AAIH, and the ACGIH. (From *ACGIH Today!* 3(1), January 1995.)