Asbestos as a Work Hazard

Determining what was known and when

By William P. Ringo

AS ASBESTOS LITIGATION begins to involve industrial and institutional premises owners, an increasing number of SH&E professionals are being asked why their employers were not more sensitive to the hazards of asbestos in the workplace. Part of the answer is that outside of a few select industries, the average SH&E professional was likely not keenly aware of these hazards until about 1980.

The hazards of mining and milling asbestos were generally known in the 1960s, as were hazards to select work groups including shipbuilders and insulators. It was well-established in the late 1960s that asbestos was a hazard which needed to be controlled in a limited number of work environments such as mills (Lynch and Ayer 431); shipyards (Marr 264) and mines [Patty(a); (b)]. Yet, general industry apparently was largely unaware of the potential hazard of installed asbestos-containing products until the late 1970s to early 1980s. Use of asbestos in the U.S. peaked in the period 1973 to 1975, then tapered off slowly through the mid-1980s (Kelly, et al).

Safety and industrial hygiene textbooks used during the 1960s and into the 1970s contained limited discussion of asbestos hazards, and these topics were normally associated with select industries. Journals generally read by SH&E professionals had limited references to asbestos as well, except for laboratory methods and select industries, until the 1980s. National conferences attended by SH&E professionals dedicated virtually no time to asbestos—other than the discussion of laboratory methods—until the late 1970s. Therefore, a reasonably well-prepared SH&E professional working in an industry not closely linked to asbestos (e.g., mining, milling and asbestos manufacturing) could well have been unaware of the serious potential hazards it posed to the end user until about 1980.

The Rise in Litigation

Now and in the near future, many SH&E professionals who worked in industrial or institutional settings from the early 1960s to the mid-1980s will face questions regarding their knowledge of asbestos-containing material in the workplace. Such inquiries usually arise during the discovery phase of personal injury litigation alleging harm from exposure to asbestos. These professionals and younger practitioners who entered the profession already knowing about the hazards of asbestos must be reminded that asbestos was not generally viewed as a hazard except in a limited number of industries. SH&E professionals may be interested in knowing when asbestos came to be regarded as a potential hazard in any workplace where it existed, particularly because litigation against premises owners is increasing.

The first wave of asbestos litigation—beginning in the early 1960s against Johns Manville and other major asbestos manufacturers—resulted in disclosures that some officials at some asbestos mining and manufacturing companies were aware of health hazards associated with high-level exposure to asbestos. Industry-supported studies conducted in the 1930s and 1940s—notably the so-called Saranac Lake studies—demonstrated various health effects in animal models. As a consequence, many of the injured claimants could use the doctrine of strict liability in their lawsuits (Brodeur).

The major producers are now bankrupt or have sought other judicial accommodations such as "asbestos trusts" to avoid further litigation. More recently, manufacturers that use asbestos in products such as washers and aircraft engine gaskets, or that had asbestos applied as an ancillary part of a product (such as field-applied boiler and pump insulation) have attracted litigation. This activity stems from difficulties plaintiffs have experienced in receiving adequate settlements from the various asbestos trusts set up in the 1980s by former major asbestos manufacturers. As funds in these trusts were depleted, less-obvious former minor users have emerged as litigation targets. Thus far, SH&E professionals who have become involved in litigation have mostly been employees of companies whose

William P. Ringo, Ph.D., CSP, CIH, *is a senior consultant with DRM & Associates in Louisville, KY. His practice concentrates on use and disposal of all types of hazardous materials and safety practices involving ionizing and nonionizing radiation. He holds a B.S. in Chemistry from Florida State University, an M.B.A. from Jacksonville State University and a Ph.D. from the University of Alabama. Ringo is a professional member of ASSE's Louisville Chapter.*

Table 1

AIHA Conference Presentations on Asbestos: 1968 to 1979

Year	Title
1970	•Public Health Service Study of Asbestos Processing Workers: Progress Report
1971	•A Study in Exposures in Spraying of Asbestos Fireproofing Material •Environmental and Occupational Hazards of Spray Asbestos Fibers •Generation and Characterization of Chrysotile for Chronic Inhalation Studies
1972	•Epidemiological Study of Asbestos Insulation Workers •Mortality Patterns Among Asbestos Textile Workers •Biological Differences to Respiration of Long and Short Asbestos Fibers
1973	•Biological Differences to Respiration of Long and Short Asbestos Fibers •Effects of Asbestos on Alveolar Clearance of Airborne Asbestos •Surface Energetics of Asbestos Minerals •Trace Metals in Asbestos and Effects on Crystal Structure •Evaluation of Office Worker Exposure to Asbestos in a Building Using Asbestos Fireproofing *(This was the first platform session of potential end-user effects.)*
1974	•Absorption of Water on Amosite and Chrysotile •Analysis of Asbestos for Trace Metals •Asbestos Control in Steam-Electric Generating Plants *(This was the second end-user study.)* •Dust Control in the Asbestos Industry •An Evaluation of PCM for Asbestos Counting
1975	•Carcinogenic Activity of Modified Asbestos Fibers •EM Studies on Asbestos in Human Lungs •Asbestos Control: An Industrial Perspective •Fiber Size Distribution for Various Operations •Asbestos Removal from 800 Student Dormitory Bedroom Ceilings (*Reviewed techniques to minimize fiber counts.*) •Technological Feasibility of Achieving the OSHA Asbestos Standard of 2 f/cc in Asbestos Textile Facilities •Asbestos Exposure in Drywall Construction (*The third end-user study.*) •A Comparative Review of Dust Conditions and Clinical Observations in Two Brake Lining Manufacturing Industries •Alignment of Asbestos Fibers in Air Samples by Magnetic Fields •The Respirability of Asbestos Fibers •Relationship Between Asbestosis in Rats and Dust Cloud Measurements •Asbestos Exposure During Brake Lining Maintenance and Repair (*The fourth end-user study.*)
1976	•Analysis of Airborne Asbestos
1977	•Exposure to Asbestos in Asbestos-Free Products •A Review of Asbestos Exposure in Ontario •A Comparison of PCM and EM Methods for Evaluation of Asbestos Fiber Exposures
1978	•Automobile Brake Linings May Be a Health Hazard (*The fifth end-user study.*)
1979	•Portable Vacuum Equipment to Control Asbestos •Asbestos Exposure in Massachusetts Public Schools (*Found levels generally well below the PEL.*) •Exposure to Respirable Coal Dust and Asbestos in TVA Power Plants (*The sixth end-user study.*)

products actually contained asbestos or may have required that asbestos be disturbed to service their products, as in the case of boilers, high-temperature valves and gauges (Morris).

The next wave of litigation began around 1995; it involves former employees or outside contractor personnel seeking redress for real or potential injury due to asbestos exposure while working on a premises such as a manufacturing facility, institution or other building where asbestos was used for building system construction rather than in the production of an article. Since many of these claimants are in their 50s and 60s and their alleged exposure occurred from the 1960s to the 1980s, it is expected that the number of premises cases will increase in the near future (Morris).

These claims often contend that the exposure was through the fault of the premises owner (the company that owned or in some cases operated the industry or institution). The principal fault argument is that the owner or the owner's on-site SH&E representative knew or should have known that asbestos was present; that it could cause disease as used in that workplace; and that adequate protection could have been provided yet was not. These conditions are generally necessary to allege injury under the "failure to warn" tort (Brennan 2).

Against this backdrop of increasing litigation, often involving claimants with alleged exposures as late as the 1980s, various initiatives have been pursued to legislate a universal asbestos trust managed by the federal government. Unless that effort succeeds, currently practicing SH&E professionals may need to know more—not only about the hazards of asbestos but also when that knowledge was widely available.

Determining What Was Known & When

What was known about asbestos hazards and when it was known by plant management and plant-level SH&E professionals cannot be learned by survey. Too much time has passed and too much has been forgotten. This was an era before the Internet and cable TV. Few people owned or had access to a computer. What is now an e-mail to multitudes was then the equivalent number of long-distance phone calls. A fax took eight minutes per page. OSHA regulations did not exist until 1972; when they did emerge, the standards targeted facilities that milled asbestos or manufactured asbestos-containing material; the permissible exposure limit (PEL) was set at five fibers per cubic centimeter (5 f/cc) of air in OSHA Subpart Z, Toxic and Hazardous Substances (29 CFR 1910.1001). No

National Emissions Standards for Hazardous Air Pollutants (NESHAP) program was in place for a large portion of the time under discussion.

So, how did SH&E professionals obtain information about asbestos hazards as well as other workplace hazards? The well-prepared plant-level SH&E professional would be expected to develop professional knowledge through a combination of initial formal training, followed by review of literature in industry magazines or journals, and contact with peers in a setting such as an annual professional conference.

What Information Was Available?

Review of typical classroom texts used during the 1960s and 1970s should shed some light on what the future SH&E professional was taught during the time in question. Professionals trained during that time were the most likely candidates for plant-level responsibility during the 1970s in particular and into the 1980s. Texts selected for review included *Patty's Industrial Hygiene and Toxicology, Fundamentals of Industrial Hygiene, Occupational Diseases: A Guide to Their Recognition* and the *Handbook of Occupational Safety and Health.* A current edition of each is still in use. Indexes were reviewed to determine the number of mentions of "asbestos" by page. Where successive editions were available, trends in the occurrence of references to asbestos over time were noted.

Review of technical and occupational health journals from the late 1960s to 1980 should reveal what literature was available to the rank-and-file practitioner. Journals selected for review were *American Industrial Hygiene Journal,* published by AIHA, and *Professional Safety,* published by ASSE. Both peer-reviewed journals are provided to members of each organization; are widely available in research libraries; and are frequently cited by members of the profession. The review documented any title that contained the word "asbestos" or mentioned asbestiform minerals such as chrysotile, amosite or crocidolite.

Review of programs from select professional conferences held during the 1970s should illustrate what the profession thought was important enough to cover at a national meeting. Brochures and available abstracts for the annual meetings of AIHA and ASSE were reviewed, as were the proceedings of National Safety Council's (NSC) National Safety Congress. In these cases, session titles and presentation titles were examined for any use of the word "asbestos."

In Texts

Industrial Hygiene and Toxicology devotes five pages to asbestos and asbestosis in Volume 1 [Patty(a) 520] and six pages in Volume 2 [Patty(a) 1117] in the first edition published in 1948; the book exclusively discusses asbestos workers as being at risk. By comparison, 38 pages are devoted to silica. The second edition (1958) devotes two pages to asbestos [Patty(b) Index]. Later versions contain more extensive mentions of asbestos and asbestos-related disease.

Fundamentals of Industrial Hygiene, first published by NSC in 1971 and now in its fifth edition, is still used in many introductory SH&E courses. The second edition was published in 1979, the third edition in 1988 and the fifth edition in 1996. The 1971 edition devotes two paragraphs to asbestos (Olishifski and McElroy 958). The 1979 edition mentions asbestos on three pages, largely within a discussion of potential diseases associated with mining and milling asbestos (Olishifski 1255). The same text expends eight pages on silica. The 1988 edition contains 18 pages that mention asbestos (Plog 896). The current edition has so many mentions that the referenced pages are subdivided into sections identified as "Asbestos," "Regulations," "Hazards," "TLV" and "AHERA" (Plog and Quinlan 1052).

U.S. Public Health Service published *Occupational Diseases: A Guide to Their Recognition* in 1966. It was reprinted by NIOSH in 1977. In the 1966 edition, the index lists two pages as being related to asbestos, one that lists asbestos workers at risk, another with a listing for asbestosis (Gafafer 328). The 1977 edition devotes seven pages to asbestos, has three mentions of asbestosis and three pages mentioning asbestos workers (Key, et al 563).

The second edition of *The Handbook of Occupational Safety and Health,* published in 1976, mentions asbestos once in a subchapter titled, "Non Metallic Dusts" (NSC 240). The 1987 edition contains 19 pages on asbestos (Slote and Lawrence).

In Conference Programs

AIHA

AIHA has held an annual meeting for more than 50 years. Obviously, the more-significant a topic is perceived to be, the more session time will be devoted to it. For example, in 2003, some 75 hours were devoted to mold and biological air-quality issues. AIHA's library has archived notices of annual meetings, brochures listing session topics and, in some cases, presentation abstracts. AIHA published an annual list of abstracts of presentations in some editions of its journal and later made the abstracts available at the annual meeting. Various materials from 1968 to 1979 were reviewed to see how many session titles contained the word "asbestos" (Table 1).

ASSE

ASSE also conducts an annual professional development conference. Conferences held from 1970 to 1980 delivered one qualifying session: 1973's "Asbestos Criteria Document Highlight," which was later reprinted in *Professional Safety* [Selikoff(a); (b)].

NSC

From 1970 to 1980, National Safety Congress featured one asbestos-related podium topic: 1977's "Asbestos in Mining's Future" (Thompson 9).

In Journal Articles

AIHA Journal

As noted, until December 2003, AIHA published the peer-reviewed *AIHA Journal.* In 2001, the group produced a disc containing all papers from 1940 that contained any mention of asbestos [AIHA(a)]. During the 1940s, one article contained the word "asbestos" in its title; it addressed analytical methods. Similarly, one

Table 2

Asbestos Articles Published by AIHA: 1970 to 1979

Year	Title
1970	•The Interrelationship of Selected Asbestos Fiber Indices (Lynch, et al) (*Comparison of fiber counting methods.)*
1971	•Determination of Iron, Chromium, Cobalt, Nickel and Scandium in Asbestos by Neutron Activation Analysis (Holmes, et al) •Identification and Control of Asbestos Exposure [Cralley(b)] (*Discussion of methods that distinguish asbestos from other dusts and fibers.*) •The Organic Content of Canadian Chrysotile (Gibbs and Hui) (*Discussion of trace compounds in Canadian asbestos mines.*) •Electromotive Phenomenon in Metal and Mineral Particulate Exposure: Relevance to Exposure to Asbestos and Occurrence of Cancer [Cralley(a)] (*Discussion of possible synergistic effects of metal atoms contained in the structure of asbestos in cancer induction.*) •Collagen Biosynthesis in Rat Lungs During Exposure to Asbestos (Davis and Reeves) •The Use of Dust Respirators Against Asbestos Dust Hazards in the United Kingdom (Luxon)
1972	•The Generation and Characterization of a Respirable Aerosol of Chrysotile Asbestos for Chronic Inhalation Studies (Craig, et al) •Application of Sprayed Inorganic Fiber Containing Asbestos Occupational Health Hazards (Reitze, et al) (*Study of exposure to applicators.*)
1973	•Asbestos, Talc and Nitrites in Relation to Gastric Cancer (Smith) (*Report of tumor induction in hamsters.*) •Improved Techniques of Identification and Determination of Airborne Asbestos (Bartosiewicz)
1974	•The Relationship Between Exposure to Asbestos, Collagen Formation, Ferruginous Bodies and Carcinoma (Flowers) •Surface Energetics of Asbestos Minerals (Gorski and Stettler) (*Physical chemical parameters of asbestos fibers.*) •The Analysis of Asbestos for Trace Materials (Lockwood) •Dust Control Techniques in the Asbestos Industry (Goldfield and Brandt) (*Review of engineering controls available to asbestos manufacturers.*)
1975	•Recommended Procedures for Sampling and Counting Asbestos Fibers (ACGIH-AIHA) •Background Documentation on Evaluation of Occupational Exposure to Airborne Asbestos (ACGIH-AIHA) (*Expands on methods in the paper published one month earlier.)* •Calibration Standards for Counting Asbestos (Ortiz, et al) •Technological Feasibility of the 2 f/cc Asbestos Standard in Asbestos Textile Facilities (Curtis and Bierbaum) •Asbestos Control in Steam-Electric Generating Plants (Fountaine and Trayer) (*First end-user report in the 1970s.*) •The Adsorption of Water and Benzene on Amosite and Chrysotile Asbestos (Gorski and Stettler) •Counting Asbestos Fibers by the Most Probable Number Method (Reist) •Physical Parameters of Airborne Asbestos Fibers in Various Work Environments: Preliminary Findings (Gibbs and Hwang) (*Investigates behavior of asbestos as an etiological agent in asbestos industrial settings.*) •Asbestos Emissions from Baghouse Controlled Sources (Harwood, et al) (*Airborne exposure in asbestos processing plants.*) •The Effects of Milling on Diameters and Lengths of Fibrous Glass and Chrysotile Asbestos Fibers (Assuncao and Corn) •A Statistical Analysis of Asbestos Fiber Counting in the Laboratory and Industrial Environment (Rajhans and Bragg)
1976	•The Porosity of Amosite and Chrysotile Asbestos (Gorski, et al) (*Uses a computer program to determine pore size.*)
1978	•Automobile Brake Linings May Be a Health Hazard ("Automobile Brake") •A Review of Asbestos Exposures in Ontario (Rajhans, et al) (*Evaluates dust levels in five asbestos manufacturing plants.*)
1979	•A Comprehensive Program in Asbestos Hazard Surveillance and Education (Felton) (*Report on the U.S. Navy program.*) •Drywall Construction and Asbestos Exposure (Fischbein, et al) (*Identifies drywall sanding as an end-user occupation that exposed workers above the PEL. The second end-user study.*) •Evaluation of Dust Exposure in Asbestos Cement Manufacturing Operations (Hammad, et al). •Automatic Detection and Counting of Asbestos Fibers ("Automatic Detection") (*Reports on a new method for asbestos exposure determination.*) •Absorption Properties of U.I.C.C. Rhodesian Chrysotile and Crocidolite in Aqueous Solution—Effects of Cation Depletion (Valerio, et al) *(Charge determination on the surface of asbestos fibers.*)

article was published in the 1950s; that article was limited to the asbestos industry. During the 1960s, 12 qualifying articles were published; of these, five covered analytical methods, four covered the asbestos industry; and two were on animal modes. During the 1970s, AIHA published 33 asbestos-related articles.

ASSE's Professional Safety

ASSE publishes a monthly journal, *Professional Safety* (formerly known as *Journal of the American Society of Safety Engineers* and *ASSE Journal*). Table 3 summarizes *PS* articles and news items from 1970 through 1980 that mention asbestos.

Discussion

Clearly, asbestos was long known to be a health hazard to a select group of people, notably miners.

Table 3

Asbestos Information Published by ASSE: 1970 to 1980

Year	Title
1972	•Standard for Asbestos Dust (*Announces 5 f/cc standard for general industry.*)
1973	•Interim Order (*Variance denied to insulators.*)
1974	•Asbestos Criteria Document Highlights (Selikoff) (*Reviews asbestos hazards to insulation workers and amosite factory workers.*)
1975	•A Model for Asbestos Removal (Osborne and Osborne) (*Reports on a post-fire removal of spray-on insulation in the Yale University library.*)
1978	•HEW Launches Program to Reach Millions Exposed to Asbestos Hazards (*Announcs public awareness program for shipyard workers in the 1940s and earlier.*)
1980	•Medical Problems, Legal Snarls Plague Asbestosis Victims (*An overview of hazards of asbestos exposure including families of exposed workers and identifies diseases commonly associated with asbestos. The article further identifies low-level, long-term exposure to be a serious issue.*)

Prior to 1980, all references to workers at risk for asbestos-related diseases in the SH&E literature reviewed for this article identified specific workgroups. These included asbestos miners, millers, asbestos products manufacturers, insulation installers, asbestos cement workers and shipyard workers. As methods of airborne fiber quantification were improved and information was more widely disseminated in the 1970s about the hazards of asbestos in its various forms, regulations were enacted to protect workers expected to be exposed at high levels (e.g, asbestos manufacturing workers). In 1972, OSHA issued the 5 f/cc general industry standard (29 CFR 1910.1001).

In 1975, *AIHA Journal* published 12 articles whose titles contained the word "asbestos." This was the most asbestos-intensive year of the decade. Most of the articles pertained to laboratory methods or to the asbestos manufacturing industry. That year also marked the first mention in the journal of asbestos risks to end-users in "Asbestos Control in Steam-Electric Generating Plants," which identified installed and replaced thermal insulation as potential exposure sources (Fountaine and Trayer 126).

"Background Documentation on Evaluation of Occupational Exposure to Airborne Asbestos" expands on previous suggestions as to the best practices for sampling and laboratory analysis of asbestos [ACGIH-AIHA(a) 91]. This article identifies at-risk populations workers performing "mining, milling, textile weaving, insulation installation and stripping, and during the manufacture and application of friction products and cement products." It also identifies workers with "intense intermittent exposure" as being at risk for disease. These early indications were expanded on by at least four other end-user studies by the end of 1979.

As knowledge of diseases other than asbestosis associated with lower levels of asbestos exposure grew, and improved and standardized detection methods became available, regulations lowering the general industry standard proceeded with new or interim standards in 1975 through 1986. Each successive standard lowered PEL based on new epidemiological information.

During this period, additional workgroups were recognized as being at risk of occupational exposure. These included construction workers who installed drywall, building maintenance personnel in buildings containing friable asbestos, others who came in regular contact with friable asbestos and auto mechanics who repaired brakes.

Conclusion

An SH&E professional engaged in safety aspects of non-asbestos manufacturing, food processing, transportation, consumer products, papermaking and a host of other work environments containing other better-known occupational hazards may well have had little concern for asbestos as a hazard in the workplace during the 1970s. Asbestos exposure for most employees working in facilities not directly linked with asbestos manufacturing, shipyards, spray application and similar high-exposure occupations was not a topic of journal articles or conference presentations until the late 1970s or early 1980s. An SH&E professional diligently pursuing an ethical career may in fact not have considered asbestos to be a health issue in his/her workplace during the late 1970s.

However, during the 1960s and early 1970s, medical and epidemiological literature citations expanded the known diseases associated with asbestos to include lung cancer, mesothelioma and possibly other cancers [Selikoff(b) 33]. These studies were almost all performed on miners, manufacturers of asbestos products, insulation workers and shipbuilders—all populations already known to be at risk for asbestosis. As these studies and other newer studies of exposure (not disease) in brake repair, drywall installation and end-user applications of asbestos-containing material made their way into the literature—reporting exposure levels above the lowered PEL—it became clear that asbestos litigation would not be limited to World War II veterans. Since these studies examined populations at work during the 1970s, they did not evaluate health effects, only future risk.

It is prudent to suspect that most SH&E professionals should have known by the middle 1980s that asbestos in any form which could easily be made airborne posed a potential exposure hazard to workers directly exposed. In 1986, when OSHA reduced its PEL by a factor of 10 (2 f/cc to 0.2 f/cc) and the school Asbestos Hazard Emergency Response Act (AHERA) was implemented, virtually all responsible SH&E professionals should have given thought to in-place asbestos as a potential hazard in their workplaces.

Now that premises litigation is escalating, an SH&E professional would do well to assess the response to any potential exposures to maintenance personnel, insulators, plumbers and outside contract craftsmen. The most vulnerable time period for undocumented exposures is the era from about 1960,

when a tremendous industrial construction boom was underway, to NESHAP regulations in the early 1980s, which mandated controls during removal of asbestos. This coincides with the exposure history of most premises plaintiffs (Brennan 2). ■

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