

ASBESTOS AND ROOFING: IS COMMON SENSE POSSIBLE

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This paper presents a synopsis of issues affecting roofing contractors who handle asbestos-containing roofing material (ACRM). It is not within the scope of this paper to present thorough discussion of all pertinent topics, rather to present current information on the major issues, including regulatory concerns, insurance/liability considerations, contractual obligations, health studies, air monitoring, testing, removal techniques and recommendations.

KEYWORDS

Asbestos-containing roofing material (ACRM), Asbestos Hazard Emergency Response Act (AHERA), Environmental Protection Agency (EPA), friable asbestos, National Emissions Standards for Hazardous Air Pollutants (NESHAPs), non-friable, Occupational Safety and Health Administration (OSHA), phase contrast microscopy (PCM), polarized light microscopy (PLM), transmission electron microscopy (TEM).

INTRODUCTION

Asbestos has been used since recorded history. Greeks referred to asbestos as the "miracle mineral" because it is soft, pliable and has a tremendous capacity to withstand heat. It wasn't until the late 1800s that asbestos was widely used in North America, when extensive deposits were discovered in Canada. Asbestos was used extensively in building materials because the fibers are extremely durable and resistant to heat and chemicals. Asbestos was used widely as insulation for pipes and boilers and used as a reinforcing material for hundreds of products, including roofing materials.

Asbestos fibers have been used in roofing felts, cement-asbestos tiles, cement-asbestos shingles, flashings, coatings, mastics and rigid cement-asbestos panels.

Although asbestos has been used since the beginning of recorded history, the health effects caused by asbestos exposure have not been documented until recently. The mineral was first used predominately during World War II for insulating and fireproofing ships. Until 1976, asbestos was required by model building codes in some areas where fire protection was crucial.

The durability of these fibers may also be one of the major problems in terms of health effects. When workers or others are exposed to asbestos fibers in the air and inhale them through normal breathing, studies have shown that this may lead to a number of serious diseases. Many of these diseases do not manifest themselves until 10 to 40 years after exposure. In addition, the synergistic effect of cigarette smoking and exposure to asbestos fibers greatly increases an individual's likelihood of contracting an asbestos-related disease.

Because of the widespread use of asbestos in building

materials and other products, and populations of asbestos workers who contracted asbestos-related diseases, the United States has enacted a number of stringent requirements regarding asbestos. As regulations are promulgated, however, they usually do not consider the unique characteristics of asbestos-containing roofing material (ACRM). EPA separates its regulations into friable asbestos and non-friable asbestos, and defines friable as, "any material containing more than 1 percent asbestos as determined using the means specified in Appendix A, subpart F, 40 CFR part 763 section 1, Polarized Light Microscopy, that when dry, can be crumbled, pulverized or reduced to powder by hand pressure." EPA, in a background statement regarding the regulation, reported, "The intent of the asbestos standard is not to control handling of vinyl-asbestos floor tile, asbestos felt roofing or other similar materials, since it is the administrator's judgment that such activities will not release asbestos in a manner which is dangerous to human health." The Occupational Safety and Health Administration (OSHA) does not distinguish between friable and non-friable asbestos; however, it regulates asbestos exposure in the workplace. OSHA's concern is employee exposure and workplace activity; EPA's concern is what is generated from the workplace and introduced into the environment.

REGULATORY CONCERNS

In the United States, OSHA, EPA and each state have laws regarding the handling of asbestos. The current OSHA regulation, effective June 20, 1986, sets a permissible exposure limit (PEL) of 0.2 fibers per cubic centimeter (f/cc) of air as an 8-hour, time-weighted average; An action level of 0.1 f/cc as an 8-hour, time-weighted average; and an excursion limit of 1.0 f/cc over a 30-minute period. No employee may be exposed to levels above the PEL or excursion limit without being provided protective equipment (e.g., special clothing, respirators, change rooms, etc.). As a result of lawsuits brought against OSHA by the Building And Construction Trades Department of the AFL-CIO, OSHA is currently revising the regulation and issued a notice of proposed rule making on July 20, 1990. An update to the OSHA regulation is expected to be issued sometime in late 1991.

The roofing industry, particularly the National Roofing Contractors Association (NRCA), a national trade association of approximately 2,500 roofing contractors, has conducted extensive research on air-monitoring data from activities involving ACRM. Basically, NRCA has separated the issue into two product categories: bituminous ACRM (i.e., built-up membranes composed of asbestos-containing felts, flashings, coatings or plastic cement) and cementitious (e.g., asbestos-cement shingles) ACRM. Most of the studies performed to date have involved bituminous ACRM. NRCA

has accumulated literally hundreds of air-monitoring tests done on workers handling these products and has yet to see any data that have exceeded OSHA's prescribed limits. However, although most of the current regulations do not apply as long as the contractor can demonstrate that exposures are below the prescribed limits, currently OSHA requires negative-pressure enclosures to be used, wherever feasible, in all asbestos removal, demolition and renovation operations. Although currently OSHA provides an exemption for the removal of asbestos-containing floor tile based on their opinion that it does not fall under the definition of asbestos removal, demolition or renovation, it does not make this exemption available for roofing. Therefore, roofing contractors must prove that it is not feasible to erect and maintain a negative-pressure enclosure during a reroofing project involving ACRM, or provide information that shows that there will be a greater health risk to the workers by providing such an enclosure. This paradox is being addressed in the OSHA notice of proposed rulemaking. In the notice, OSHA proposes to exempt roofing from the negative-pressure enclosure requirement; however, OSHA also proposes to require additional controls for the handling of ACRM. Under the current regulation it is clear that the employer's obligation is to utilize work practices and engineering controls to reduce exposures below the prescribed limits, and if this is not possible, to provide employees with protective equipment and clothing. OSHA prefers to reduce exposures through these means rather than to require employees to wear protective clothing and equipment. OSHA prefers work practices and engineering controls to reduce the problems associated with using respirators and other types of protective equipment in a roofing environment.

The Environmental Protection Agency (EPA) has promulgated three major asbestos regulations:

- The National Emissions Standards for Hazardous Air Pollutants (NESHAPs).
- The Asbestos Hazard Emergency Response Act (AHERA).
- A rule banning the manufacture and use of most asbestos products, (approximately 94 percent of all asbestos products) including all roofing materials.

THE NATIONAL EMISSIONS STANDARDS FOR HAZARDOUS AIR POLLUTANTS (NESHAPs)

First promulgated in 1973 under the Clean Air Act, this regulation was revised in 1975 and 1978 to cover building renovations and asbestos emissions from asbestos-containing waste material and were re-promulgated on April 5, 1984. The purpose of the NESHAPs regulation is to prevent the discharge of any visible emissions of particulate asbestos material to outside air. As opposed to OSHA, the regulation does not set a numerical standard for asbestos emissions, and is applicable only to friable asbestos. EPA generally considers ACRM to be non-friable. However, due to sawing, chopping or cutting, some EPA officials may consider it differently. If friable asbestos is created from non-friable asbestos, then it is subject to the regulation. Whenever friable asbestos-containing materials are being removed, NESHAPs requires the friable asbestos materials to be adequately wetted and placed in individual, labeled, polyethylene bags or similar containers. In addition, EPA must be

given notice at least 10 days prior to any renovation involving friable asbestos.

EPA is divided into 10 regional offices and many states and even counties can be designated as EPA administrators. This indicates that the term, 'friable,' is rather subjective and may be interpreted differently throughout the country. To date, the best option for a roofing contractor is to contact his local EPA administrator to find out what the current requirements are for his area. EPA is planning to revise NESHAPs in the near future.

ASBESTOS HAZARD EMERGENCY RESPONSE ACT (AHERA)

Signed into law on October 22, 1986, as Title II of the Toxic Substance Control Act (TSCA), the act requires all school systems (AHERA applies only to schools, not other buildings) to identify, develop management plans for, and abate asbestos hazards in school buildings. The AHERA regulation is intended to cover asbestos in school buildings. *AHERA does not apply to roofing materials.*

ENVIRONMENTAL PROTECTION AGENCY (EPA) BAN

As mentioned earlier, EPA has banned asbestos-containing roofing materials in a phased-in approach. As of August 1990, EPA prohibits the use of asbestos-containing roofing felts. This has virtually no impact on the roofing industry in the U.S. because asbestos felts have not been used to any significant degree for at least 10 years. However, by August 1996, EPA will ban the use of other asbestos-containing roofing materials such as asbestos-cement shingles, roof cement and asbestos coatings. Currently, some U.S. manufacturers are suing EPA over the ban because they and asbestos industry organizations feel the ban is unfair and unwarranted. Many manufacturers and organizations believe asbestos may be used in a controlled, safe and efficient manner, and that EPA has not proven the use of asbestos in products, where the fibers are encapsulated, presents a health problem. Also, there is concern about the health effects of the substitutes that will be used in place of asbestos.

STATE ACTIVITIES

Because of the high visibility of the asbestos issue, an entire new industry of abatement contractors, consultants, inspectors and management planners surfaced in the early 1980s. To get a better handle on the thousands of projects involving asbestos each year, virtually every state in the U.S. has some type of asbestos licensing law. Generally, these are aimed at those handling friable ACM. Most states have enacted statutes requiring licensing and/or certification of contractors and/or workers performing asbestos work. Licensing courses typically require an approved training course of a prescribed duration in the removal, abatement, encapsulation, and health and safety aspects of asbestos. For the most part, states require the same type of work practices, engineering controls and levels of air-monitoring results as in the federal regulations. Because many of the requirements for state licensing tie into the handling of friable asbestos, a roofing contractor can run into the same problem as with EPA in the interpretation of ACRM friability. Therefore, it is not unusual to have two similar state regulatory statutes with one interpreted to require roofing contractors to be licensed and the other not to require them to be licensed, based on

the interpretation of the friability of the materials. Some states have specifically exempted roofing from their regulations (e.g., New Jersey, Kansas, Minnesota and Oregon). Some states have adopted specific licenses and regulations for the handling of asbestos-containing roofing materials (e.g., Georgia, Virginia, Florida and New York). Roofing contractors handling ACRM should check with state officials to determine the extent, if any, of licensing and training requirements for handling the types of materials handled on roofing projects. A few states have even enacted legislation limiting the liability of government officials or the contractor's liability while performing asbestos-related work, except in cases of negligence or violations of laws or regulations.

INSURANCE/LIABILITY CONSIDERATIONS

The liability issue is perhaps the most complicated when determining how asbestos roofing projects are handled. Certainly the contractor and building owner have potential liability under federal and state regulations; however, even if they comply fully with all regulations, there still may be additional potential liability from building occupants or others who decide to sue. Designers (roof consultants, architects and engineers) also have liability concerns regarding recommendations for handling ACRM. The key is for all parties involved to consider health and safety issues when recommending a plan of action for handling ACRM. By following interior "asbestos abatement" specifications for roofing work, designers or contractors may be putting employees at a much greater immediate risk of harm by presenting immediate health and safety hazards. For example, requiring roofing workers to work in enclosures, wear negative-pressure respirators and protective suits greatly increases the chances of heat stress, and may even create problems in fall prevention.

Insurance coverages for roofing contractors basically take two forms: an existing liability policy which does not have an asbestos exclusion, or a separate asbestos insurance policy. Some insurance carriers do not have an asbestos exclusion in the general liability policies, however, they do include the exclusion in the umbrella policies. While these policies are not intended for asbestos abatement work, as long as the contractor handles only roofing materials and uses good work practices, the insurance company should respond if a liability claim is made. These policies do not, however, offer a statement of insurance which many owners may require before allowing a contractor to bid or perform work. Some insurance carriers have entered the market and offer liability policies to roofing contractors who handle only ACRM. These carriers will provide a statement of insurance and will offer true "occurrence" coverage. For asbestos liability coverage, contractors will want to strongly consider only a true "occurrence" policy rather than a "claims-made" policy. In a "claims-made" policy, coverage is only in effect for the duration of the policy. If the carrier decides not to renew the policy or the insured changes carriers, the policy will no longer respond. Given the latency period of asbestos-related diseases and long-term liability potential, typically, a "claims-made" policy is not a very good idea for asbestos coverage. True "occurrence" policies, however, will respond regardless of when the claim is actually made. Some "occurrence" policies have sunset clauses, which may limit additional exposure for the insurer. Generally, a sunset clause

of three to five years is common. In an ideal situation, the contractor will have true "occurrence" coverage with no sunset clause. The next best option is to have true "occurrence" coverage with a lengthy sunset clause. The least preferable option is "claims-made" liability insurance. Typically, "occurrence" policies are available on a per project basis with a premium of approximately 5 percent of the project cost. Of course, all contractors should discuss their insurance needs with their insurance advisor to completely understand all applicable insurance coverages and exclusions before beginning any asbestos-related work.

CONTRACTURAL OBLIGATIONS

Whether or not a roofing contractor intends to perform any asbestos-related work, he needs to strongly consider "hold harmless" language in any contracts that he enters into. A contractor could encounter asbestos unexpectedly or encounter other types of asbestos material that he did not know about. How this situation will be handled should be clearly defined before the project begins. A sample of "hold harmless" language for this type of situation reads as follows:

"This proposal is based on the assumption that the existing roof does not contain asbestos or any material containing asbestos. Contractor is not engaged in the identification, abatement, encapsulation or removal of asbestos or asbestos-containing materials and will not be responsible for asbestos abatement or removal. In the event that asbestos or material containing asbestos is discovered during the course of the work described in this proposal, Contractor reserves the right to rescind this contract and receive payment for work performed or suspend its work for a reasonable period of time while the Owner engages a firm specializing in the removal and disposal of asbestos to remove the asbestos from the work site. Contractor shall be entitled to reasonable compensation for extra expenses incurred by Contractor as a result of the presence of asbestos-containing material at the work site." "Contractor is not responsible for any claims, demands, or damages arising out of the removal of asbestos from the work site and the Owner, by accepting this proposal, agrees to release Contractor from any such claims, demands or damages." "The Owner, in consideration of Contractor performing the work in this contract, hereby agrees to indemnify, defend and hold harmless Contractor from and against any and all liability, damages, losses, claims, demands or lawsuits arising out of or relating to the presence of asbestos or asbestos-containing material at the work site."

The American Institute of Architects (AIA) documents A201 and A401 call for the contractor and subcontractor to stop work if they encounter asbestos which has not been rendered harmless. This language reads as follows:

"In the event the Contractor encounters on the site material reasonably believed to be asbestos or polychlorinated biphenyl (PCB) which has not been rendered harmless, the Contractor shall immediately stop work in the area affected and report the condition to the Owner and Architect in writing. The Work in the affected area shall not thereafter be resumed except by written agreement of the Owner and Contractor if in fact the material is asbestos or polychlorinated biphenyl (PCB), and has not been rendered harmless. The work in the affected area shall be resumed in the absence of asbestos or polychlorinated biphenyl (PCB), or

when it has been rendered harmless, by written agreement of the Owner and Contractor, or in accordance with final determination by the Architect on which arbitration has not been demanded, or by arbitration under Article 4."

A contractor who intends to handle ACRM using good work practices and demonstrating low exposures may want to include "hold harmless" language in his contracts well. Sample "hold harmless" language is: "Provided subcontractor conducts his operations in accordance with the applicable requirements established by the Occupation Safety and Health Administration and the Environmental Protection Agency, Owner agrees to exonerate, indemnify, defend and hold harmless Subcontractor from and against all claims, demands and lawsuits and all damages, expenses and losses incurred by Subcontractor's removal of asbestos-containing materials from Owner's building and work site."

Another major area roofing contractors need to consider is "asbestos free" contracts for new roofing systems. Increasingly, building owners are specifying "asbestos free" materials to be used for replacement roofing systems. In such instances since some roofing materials still contain asbestos (e.g., roof coatings, cements), the roofing contractor needs to be sure that the materials he will be using to install the new roof system do not contain asbestos. A manufacturer's literature or material safety data sheet may read "mineral fiber" or "fibrated" and not reveal the product contains asbestos. If this is the case, the contractor needs to verify what, in fact, are the fibers used in the materials.

RECENT HEALTH STUDIES ON ASBESTOS EXPOSURE

Currently, there is no direct evidence linking asbestos-related diseases to roofing workers who have handled asbestos-containing roofing materials. Roofing materials used chrysotile asbestos, and recent evidence indicates that exposure to low levels of chrysotile asbestos may not be as bad as once thought, and is certainly not as bad as exposures to amphibole asbestos. When disturbed, roofing materials emit very low levels of chrysotile asbestos, if any. This, coupled with the lack of any evidence of asbestos-related disease to roofing workers, may prove to be good news for the roofing industry if the record of no diseases continues.

AIR MONITORING AND TEST METHODOLOGY

Basically, there are three types of analysis by microscope (microscopy) that roofing contractors should be aware of:

- Polarized light microscopy (PLM)
- Phase contrast microscopy (PCM)
- Transmission electron microscopy (TEM)

Polarized light microscopy (PLM) is used for assessing the approximate percentage of asbestos that may be contained in materials. For example, a roofing felt examined by PLM may reveal approximately 10 percent to 30 percent chrysotile asbestos. One of the difficulties in PLM analysis of roofing material is that the asbestos fibers are well encapsulated with bituminous material. When this material is examined under the microscope, the microscopist is not always able to identify what exact percentage of asbestos is actually in the sample. Therefore, an educated guess is made as to the percentage of asbestos that the material contains. However, it is important that the microscopist identify that the materi-

al contains asbestos. Material samples taken for PLM analysis are referred to as "Bulk Samples."

Phase contrast microscopy (PCM) is the most frequently used method to analyze air sampling. This method is specified in the OSHA regulations, 1926.58 Appendix A. In fact, OSHA only accepts PCM for compliance with its asbestos regulation. The advantage of PCM is that it is readily available, relatively inexpensive, and can be completed quickly. A limitation of PCM is that it cannot determine which fibers are asbestos; it will count fibers, but it will count them all. For roofing materials, there are actually more non-asbestos fibers counted using PCM than there are asbestos fibers. In fact, it's common that when handling asbestos-containing roofing materials, the fiber release from materials such as insulation board is counted as asbestos fibers under PCM analysis. The PCM method of analysis assumes, that on asbestos projects, the only types of fibers that will be disturbed are asbestos. Also considered are cost and availability factors. In terms of OSHA compliance, however, air monitoring data gathered from NRCA indicate that, even using the PCM method of analysis, while handling bituminous roofing materials, roofing contractors can expect to have readings below a 0.1 f/cc reading as an 8-hour, time weighted average basis, and below a 1.0 f/cc reading in any 30-minute period. This means that most asbestos-abatement type practices would not be required.

A far more sophisticated method of analysis is transmission electron microscopy (TEM). This type of analysis can identify asbestos fibers and counts them separately from those fibers other than asbestos. The disadvantage of TEM is that it is relatively expensive, is not readily available, and has a fairly long turnaround time. When having air-monitoring results analyzed from the personal breathing zones of roofing workers, it's a good idea to plan to have all of them analyzed by PCM and those with the highest readings analyzed by TEM. This will enable the contractor and workers to get a feel for the actual asbestos fiber release that is occurring while handling the particular materials, and the effectiveness of work practices used. Currently, under AHERA, EPA sets a clearance reading of 0.01 f/cc (TEM) as a post-abatement clearance requirement. This means that when an abatement contractor has completed the removal of friable asbestos from inside a building, he must achieve a TEM clearance reading of 0.01 f/cc before the building may be re-occupied. Typically, on roofing jobs, TEM results are well below a 0.01 f/cc reading when analyzed by TEM.

REMOVAL TECHNIQUES

There have been a number of work practices and engineering controls that have been attempted on roofing projects to reduce exposures. Basically the best advice is to use common sense. Of course, all ACRM should be carefully handled to keep the material in a non-friable condition and to minimize the creation of asbestos-containing dust. The analysis of hundreds of air-monitoring data shows no difference between using a roof cutter or hand tools on these materials. In fact, a roof cutter may be preferable because heat is generated at the blade which helps to heat the bituminous materials and encapsulate the fibers. SRI International, (formerly Stanford Research Institute), confirms these findings in an independent analysis of air monitoring data. Also, roof cutters offer smooth, even cuts into the material which

make it easier to handle. Cuts should be made as large as possible so that there is a minimal amount of cutting. Contractors should examine the use of water (a fine mist sprayed in the vicinity of the cutting operation) for controlling dust during this cutting operation. Obviously, there are going to be times where it is not advisable to bring water on a roof because of safety factors, or because of the possibility of damage to the building's interior. Interestingly enough, air-monitoring data do not indicate that wetting makes a difference in actual asbestos fiber counts. However, because of EPA's "no visible emissions" NESHAPs provision, the use of water for controlling dust may be the best way to achieve compliance. Air infiltration into the building should be minimized by closing air conditioning intakes, vents, windows, etc. The materials should always be carefully handled from the time they are disturbed to the time they are lowered into a truck or dumpster. This indicates the materials should be lowered to the ground using a hoist, crane or enclosed chute. When using a chute, it is fairly easy to wet the material to minimize any dust from being created during transport. Obviously, an enclosed chute is preferable. The truck or dumpster can be lined with two layers of 6 mil minimum polyethylene in order to contain all the ACRM material. If these work practices are followed, ACRM that is in reasonable condition can be removed in a safe and cost effective manner, and roofing contractors can perform the work and will be able to keep the building watertight.

Appropriate disposal of these materials poses another question. Again, EPA NESHAPs covers only friable materials, therefore, if the material is non-friable, no particular landfill restrictions apply. However, many private landfills do have some particular requirements for handling ACRM and will charge a premium for it. The best solution for roofing contractors is to be straightforward with the landfill owner. That is, the contractor should determine before the job is bid or the material is removed, the particular restrictions of the landfill. In some cases, roofing contractors have driven the tear-off materials to a landfill farther away to save money. There is no known particular hazard with putting ACRM in landfills. Typically the material is covered within a relatively short period of time (certainly less than one year) and as long as the bituminous or cementitious binder or coating is not subjected to ultraviolet light, it will not deteriorate at an accelerated degree. Because of the encapsulating effect of the binders, the fibers should remain encapsulated indefinitely.

NRCA RECOMMENDATIONS

NRCA's Asbestos Committee and counsel have developed the following recommendations for roofing contractors who are involved with a project involving ACRM. The roofing contractor should do the following:

- Carefully examine all roofing materials prior to bidding and roof removal work. Make sure the owner is aware of any asbestos-containing materials and understands that these materials are his responsibility.
- Examine the underside of the roof deck to ensure no asbestos will be released by vibration or impact of roofing work. If a designer is involved, he should be responsible for a pre-work identification survey.
- Become familiar with OSHA, EPA and state regulations.

- Examine insurance policies.
- Contact state or local EPA administrators for determinations regarding disposal. Also contact the landfill operator.
- Examine contract documents and include "hold harmless" language.
- Establish a company policy about handling asbestos-containing materials.
- Conduct employee training programs so that workers are aware of the handling procedures they should follow.
- Always handle ACRM carefully so that the material remains non-friable, and fiber release is minimal.
- Develop anti-smoking programs for workers who encounter even extremely low levels of exposure. Roofers have been cited as being among the heaviest smokers in the country and there is a synergistic effect between smoking and asbestos-related diseases.
- Keep records of all asbestos-containing roof removal projects, including air-monitoring data.

SUMMARY

It is common knowledge that high exposures to asbestos are dangerous. However, when it comes to roofing materials and asbestos, at this point, many questions have yet to be answered, but certainly it is known that the risks of handling ACRM are low.

Common sense should prevail, but many times it does not. With an understandable concern for liability in today's litigious atmosphere, it is difficult to develop a common sense approach for roofing work. However, as the evidence continues to mount, and as regulations are being reviewed and revised, hope still lingers that common sense will, once and for all, prevail.

CONCLUSION

Roofing is an art that requires specialized education in training, application and removal techniques. It also demands continuing worker safety education, training and monitoring. To assure the highest degree of quality for building owners, the entire roofing process should remain in the hands of roofing professionals.

REFERENCES

- "Asbestos in the Atmosphere," Asbestos Information Association/North America, Arlington, Va., revised August 1987.
- "What You Should Know About Asbestos and Health," Asbestos Information Association/North America, Arlington, Va., September 1986.
- "Asbestos: A Natural Substance for Modern Needs," Asbestos Information Association/North America, Arlington, Va.
- "Does the EPA Really Have a Case Against Chrysotile Asbestos?," The Asbestos Institute, Montreal, Canada.
- Mossman, B.T., Bignon, J., Corn, M., Seaton, A. and Gee, J.B.L., "Asbestos: Scientific Developments and Implications for Public Policy," *Science Magazine*, Volume 247, January 29, 1989.
- "Property/Liability Guide - Commercial Umbrella/Excess Liability (AB33)," CNA Insurance Companies, Chicago, Ill., January 15, 1990.

Crysal, R., "Living With Asbestos," Medical and Health Annual, Encyclopedia Britannica, 1986.

National Emission Standards for Hazardous Air Pollutants, 40 CFR 61.140 et seq., Environmental Protection Agency. 40 CFR part 763 (Asbestos in Schools), Environmental Protection Agency. Section VI, Toxic Substance Control Act (EPA Ban & Phase Out), Environmental Protection Agency.

Letter to Carl Good from Robert McNally, Acting Chief, Regulatory and Technical Assistance Branch, Chemical Control Division, Environmental Protection Agency, May 18, 1988.

"Asbestos Abatement Projects, Worker Protection Rule," 52 FR 5623, 1987, Environmental Protection Agency.

"A Guide to Respiratory Protection for the Asbestos Abatement Industry," Environmental Protection Agency/NIOSH, September 1986.

"Asbestos Abatement Projects in the Roofing Industry," course workbook, Georgia Technical Research Institute, Atlanta, Ga., 1988.

Discussion with Steven Phillips, NRCA General Counsel, Hendricks, Spanos and Phillips, Atlanta, Ga.

"Commercial General Liability Coverage Form," Insurance Services Office, Inc., New York, N.Y., 1982, 1984.

"Asbestos Report," National Roofing Contractors Association, Rosemont, Ill., 1988.

Mossman, Brooke T. and Gee, J. Bernard L., "Medical Progress, Asbestos-Related Diseases," *The New England Journal of Medicine*, June 29, 1989.

"Asbestos Final Rule," 1926.58, Occupational Safety and Health Administration, Washington, D.C., June 20, 1986.

"Asbestos in Roofing," The Roofing Industry Educational Institute, Englewood, Colo., course workbook, May 1989.

"What You Should Know About Asbestos in Buildings," Safe Buildings Alliance, Washington, D.C., 1986.

"Exposure to Asbestos During Roofing Removal," SRI Project PYC-8654, SRI International and Fowler Associates, Menlo Park, Calif., September 1990.

Spengler, John D., Ozkaynak, Haluk, McCarthy, John F. and Lee, Henry, "Summary of Symposium on Health Aspects of Exposure to Asbestos in Buildings," August 1989.