THE IMPACT OF ASBESTOS ON HUMAN HEALTH: IMPLICATIONS FOR THE AUTOMOTIVE INDUSTRY

Osu Bassey Ngwobia[1] and Wada Shehu[2]
[1,2]Department of Mechanical Engineering Technology,
Nigerian Army College of Environmental Science and
Technology Makurdi Benue State.
Email: bngwobia@gmail.com

Abstract
Exposure to asbestos poses a considerable threat to human health and is a major public health challenge. This study explores the impact of asbestos exposure on human health, with a specific focus on its implications for the automotive industry. Grounded in the Occupational Safety and Health Administration (OSHA) asbestos regulation framework, the research evaluates the toxicological effects of asbestos fibers, especially chrysotile, which has historically been used in brake pads, clutches, gaskets, and insulation materials. The theoretical framework is underpinned by Occupational and Environmental Health, emphasizing the interaction between workplace exposures and long-term health outcomes. The study utilizes secondary data from peer-reviewed epidemiological studies, World Health Organization (WHO) reports, the International Agency for Research on Cancer (IARC), and case studies from automotive manufacturing and repair settings across the U.S., Europe, and Asia. Data analyzed includes incidence rates of Mesothelioma, asbestosis, and lung cancer among automotive workers over a 30-year period. A mixed-methods analytical approach was employed. Quantitative data were statistically analyzed using trend analysis and regression models to identify correlations between exposure duration and disease onset. Qualitative data from occupational health audits and interviews with auto-repair workers were thematically analyzed to understand workplace practices and awareness of asbestos risks. Findings confirm a significant correlation between asbestos exposure in automotive work environments

and increased incidence of respiratory illnesses, particularly among long-term mechanics and factory workers. The study concludes by recommending stricter regulatory enforcement, mandatory training programs, and the adoption of asbestos-free alternatives.

Key word: Asbestos, Human health, Mesothelioma, Carcinogen

Introduction

Asbestos is a class of minerals known for its insultating and heat-resistant qualities, which were extensively employed in various different industries, including the automobile sector. However, Mesothelioma, lung cancer, and asbestosis are among the major health issues that have been connected to asbestos exposure Stayner etal., (2018). The use of asbestos in brake pads and other parts by the automotive industry has sparked worries about possible health hazards to consumers, employees, and the environment. Human health is negatively impacted when asbestos fibers are inhaled. The toxicity of asbestos has been known since the early twentieth century and associated almost entirely to pleural Mesothelioma. Isabel Magdalena etal. (2013) However, Mesothelioma treatment and asbestos removal are not mutually exclusive. Asbestos is a very mechanically resistant substance because of its special crystalline structure. It is the perfect material for applications needing a high resistance to mechanical harm because of its flexible yet incredibly robust fibers. The distinctive structure of asbestos fibers, which enables them to retain mechanical integrity under heavy pressures without breaking, is what gives them their resilience. These fibers can be blended with other materials, mixed with cement, or woven into textiles to create incredibly adaptable composites. Durczak Karol etal. (2014). Uses for asbestos-related materials.

Asbestos has been used in many industrial applications: There are over 3000 different types of asbestos-containing goods that are utilized in different applications according to Sakakibara and Uehara (2006), approximately 80% of the asbestos imported from Japan in 2006 was utilized for

construction materials, asbestos board, and other cement products; 7% was utilized for friction materials; and less than 3% was utilized for asbestos textiles. Asbestos can be utilized as sound-absorbing tiles, wall panels, pipe insulation, roof tiles, ceiling floor tiles, and housing panels. During the manufacturing of automobiles, asbestos can be utilized as a friction material in clutch pads. McCarthy etal., (2023).

A family of naturally occurring hydrated silicates is collectively referred to as asbestos. The capacity to be divided into different threads, or structures, with one dimension noticeably bigger than the other two, is the defining characteristic of this mineralogical category.

Asbestos fibers have excellent tensile strength, longevity, and resistance to chemical and thermal deterioration, among other physical and chemical characteristics. The fibrogenic and carcinogenic potential of asbestos species varies depending on their physiochemical characteristics, even though they belong to the same mineralogical family. Dotson etal., (2006), Asbestos: Inflammability and thermal isolation are the primary features of asbestos, it is a mineral because of these characteristics, asbestos is utilized in practically every industrial area for a variety of purposes. The groups most at risk of asbestos fiber exposure are construction workers, painters, fiber cement plant employees, and carriers of asbestos products. Compared to asbestos-related lung cancer, Mesothelioma is more well-known for its link to simple environmental exposure. (Isabel Magdalena etal. 2013).

Objectives

This study's objectives are to:

1. Examine how asbestos affects human health, including the dangers and consequences of exposure.
2. To investigate the effects of asbestos use on the environment, consumers, and employees in the automotive sector.
3. To determine safety precautions that can reduce asbestos exposure and possibly replace asbestos with

other materials since it has potential risk to occupational health.

Type of Asbestos Species

Based on differences in their chemical and physical characteristic, the individual asbestos species are separated into two different groups: serpentine and amphiboles. About 95% of all asbestos used commercially in the United States is composed of chrysotile fibers, the only member of the serpentine asbestos group. Dotsonn etal., (2006).

Dimensions of Asbestos Fiber: According to Stanton's theory, the physical characteristics of asbestos fibers have an impact on the path physiology of diseases linked to asbestos exposure. Deposition into the lungs and clearance are the two main variables that are impacted by asbestos fibers' physical characteristic. The capacity of fibers to deposit in the lungs is determined by their length and diameter, which in turn influences the start of both benign and malignant diseases. Exposure to asbestos offers serious health dangers to people, especially those working in the automobile industry. Asbestos has a complex effect on human health that has major ramifications for consumers, employees, and the environment.

Level of Asbestos Exposure: The extent of asbestos exposure has a direct impact on the development of diseases linked to asbestos. Frequent exposure to high quantities of airborne asbestos fibers has been conclusively linked to Mesothelioma, lung cancer, and asbestosis. Dotsonn etal., (2006). Diseases linked to asbestos: Numerous illnesses, such as asbestosis, lung cancer, and Mesothelioma, can result from asbestos fiber exposure.

a. Latency period: These diseases' lengthy latency periods (the interval between exposure and diagnosis) can make early detection difficult and raise death rates.

Mesothelioma: asbestos exposure is closely linked to malignant Mesothelioma, a type of cancer that attacks the lining of the abdomen or lungs.

b. Mesothelioma and Lung Cancer: Exposure to asbestos

raises the chance of mesothelioma, an uncommon and aggressive lung lining cancer, as well as lung cancer. According to studies, amphibole asbestos may be more dangerous than chrysotile asbestos, especially when it comes to the risk of Mesothelioma. Women who had resided at an affected property did not have any Mesothelioma as People who had lived in homes insulated with loose-fill asbestos also seemed to have a higher incidence of prostate cancer in men and colon cancer in women. Dr. Rosemary J. Korda etal., (2017).

c**. Pleural disease and asbestosis:** Exposure to asbestos can result in alterations to the membranes around the chest cavity and lungs (pleural disease) as well as lung scarring asbestosis. a pulmonary lung disease that is commonly described as diffuse and bilateral pulmonary interstitial fibrosis brought on by asbestos dust inhalation (Oury etal., 2014). Chest pain, trouble breathing, and other consequences might result from these illnesses. McCarthy etal., (2023).

Other than Mesothelioma, asbestos can induce pleural diseases such as pleural thickening, pleural effusion, and pleural plaques. Compared to parenchymal asbestosis, nonmalignant asbestos-related pleural illness is more prevalent and typically requires less exposure to manifest. James, Efia S., etal. (2023).

An increased risk of cancers of the larynx, ovary, pharynx, stomach, and colon has also been connected to asbestos exposure. Lung cancer risk is significantly increased by smoking and asbestos exposure. in a poll of the impacted residents. Lynch and Smith (1935) were the first to observe and report asbestos-related lung cancer in asbestos workers. Theories can be used to explain the connection between asbestos exposure and the risk of lung cancer (Cullen, 1987). According to the first theory, individuals with asbestosis are solely at risk of developing lung cancer as a result of the disease according to McCarthy etal. (2023), more men than women (85% vs. 41%) reported going into the roof space of residential properties. Among men who reported going into the roof space, 15% reported doing so more than fifty times. Dr. Rosemary, J. Korda etal., (2017).

Statement of the Study

Although asbestos is known to pose health concerns, the car sector has been sluggish to embrace safer substitutes. The effects of asbestos on human health and the ramifications for the industry require more investigation and education.

Inhaling asbestos fibers from job exposure is the primary risk factor for developing ARD. However, asbestos-related disease (ARD) does not develop in everyone who has been exposed to asbestos. Many ARDs around the world are still not taken into consideration or identified as a sickness linked to the workplace according to Spain's Royal Decree 1995/1978 of May 12, Mesothelioma, asbestosis, and asbestos-related lung cancer are all considered work-related illnesses. Isabel Magdalena etal. (2013)

Methodology and Materials

This study makes use of research on the negative health effects of asbestos exposure and its application in the automobile sector. In order to comprehend the dangers and health consequences of asbestos exposure, the study examines epidemiological research, case studies, and experimental investigations.

Theoretical Framework of this study is grounded in the Environmental Health Risk Assessment (EHRA) framework, which provides a systematic approach to evaluating health risks associated with environmental exposures, including occupational hazards (National Research Council, (1983). The framework involves four core components: hazard identification, dose-response assessment, exposure assessment, and risk characterization.

Additionally, the Occupational Exposure Theory guides the interpretation of the relationship between workplace exposure to hazardous substances such as asbestos and long-term health outcomes, particularly within high-risk sectors like the automotive industry (Levy & Wegman, 2000).

Research Design: This study adopts a mixed-methods design, combining quantitative epidemiological data analysis with qualitative content analysis of occupational health reports and

interviews. The goal is to establish both statistical associations and contextual understanding of asbestos exposure in the automotive sector.

Materials and Data Sources

Secondary Quantitative Data on asbestos-related diseases (ARDs) such as Mesothelioma, asbestosis, and lung cancer were obtained from: World Health Organization (2020). Asbestos: elimination of asbestos-related diseases, International Agency for Research on Cancer (2012). Asbestos (chrysotile, amosite, crocidolite, tremolite, actinolite, and anthophyllite).

World Health Organization (WHO) (Occupational Safety and Health Administration (OSHA) National disease registries (e.g., CDC WONDER database in the U.S.) Industry-specific data on asbestos use in automotive components were sourced from: Automotive Manufacturers Association reports Historical material safety data sheets (MSDS) Peer-reviewed journals (e.g., International Journal of Occupational and Environmental Health)

Qualitative data review of occupational health case studies from automotive repair and manufacturing environments.

Analysis of worker interviews, drawn from prior studies and publicly available oral histories. Review of industrial safety protocols and compliance audits.

Data Analysis Methods: Quantitative analysis descriptive statistics were used to summarize disease incidence, mortality rates, and demographic distributions. Time-series analysis identified trends in asbestos-related disease occurrence from 1990 to 2020 among automotive workers. Logistic regression models assessed the relationship between duration/intensity of asbestos exposure and likelihood of disease diagnosis. Berman, etal. (2008).

Qualitative analysis of a thematic content analysis approach was applied to textual data from interviews, case reports, and safety audits. Ethical considerations of all secondary data used were publicly available or anonymized. Berman, etal. (2008).

Automobile Components of Asbestos

Large amounts of ACMs have historically been utilized by the automobile industry in the manufacturing of light-duty trucks and passenger cars. Consequently because of its relative abundance, asbestos was a cheap and easily accessible supply of fibrous material. Furthermore, asbestos's physical and chemical characteristics made it possible for automotive parts and components to endure the stress induced by the operation of contemporary automobiles. Asbestos was used in the production of three main categories of automotive parts: 1) gaskets, 2) sealants, and 3) friction materials. Dotsonn etal. (2006) conducted experimental research on the dangers of asbestos exposure and its impact on health.

There is substantial evidence linking asbestos fiber exposure to a higher risk of asbestosis, pleural illness, Mesothelioma, and lung cancer. Nevertheless, little is known about how fiber size affect the likelihood of respiratory illnesses linked to asbestos exposure. Experimental investigations in rodents have long suggested that the most harmful fibers are long, thin ones. In tests involving pleural injections of asbestos in rats, Stanton and colleagues found that long (e.g., > 8 ìm) and thin (e.g., < 0.25 ìm) fibers best predicted carcinogenicity. Leslie Stayner etal. (December 2007) found that rats exposed to chrysotile enriched for fibers > 5 ìm for an extended period of time had a greater percentage of lung tumors and more advanced fibrosis than rats exposed to an equivalent quantity of chrysotile with more short fibers. The study also found that fibers longer than 20 ìm were the most important predictor of lung tumor response in a reanalysis of rat inhalation experiments. (Stayner, Leslie, etal., (December 2007).

Because prior epidemiologic studies have either measured exposures gravimetric methods using mass or fiber counting with phase contrast light microscopy (PCM), as required by regulations, there is a very limited amount of human data on the relationship between fiber dimensions and respiratory disease risks.

AN OVERVIEW OF EPIDEMIOLOGICAL RESEARCH

The effects of asbestos on human health, specifically in the automobile sector: Epidemiological studies that examined personnel exposed to asbestos during brake maintenance were reviewed. Most studies did not find a substantial elevated incidence of asbestos-related malignancies among mechanics. Nonetheless, the research emphasizes how crucial it is to evaluate exposure level and fiber type in order to prove causation. In order to reduce exposure, the car industry is moving toward safer substitutes including ceramic-based materials and non-asbestos fibers and putting in place efficient safety measures. To avoid contaminating the environment, proper waste management is also essential, including stabilization and solidification. Key findings by Dotsonn et al. (2006) include:

In a case-control study, McDonald and McDonald discovered that garage mechanics had a relative risk of 0.90 (95% CI 0.39-2.13). according to Teta etal., (1983) mechanics had a relative risk of 0.65 (95% CI 0.08-5.53), meaning they were not at higher risk of developing diseases linked to asbestos according to Hansen's cohort study, the standard mortality rate (SMR) for all malignancies in mechanics was 115 (95% CI: 97–136). In order to reduce exposure, the industry must embrace safer substitutes and put in place efficient safety procedures, as the text highlights. According to Dotsonn etal., (2006), specific implications of Asbestos materials in automotive Industries, modern techniques for managing asbestos waste, such as stabilization and solidification, are being developed to assure safe disposal and lessen environmental contamination.

To highlight the dangers to working consumers posed by asbestos usage in the car industry:

The following below are the automotive components:

Automobile Components

Brake pads: When braking, older cars frequently employed brake pads that contained large amounts of asbestos, which emitted dangerous dust. For car mechanics and garage

workers, the possibility of fiber release from asbestos-containing automotive components and materials during maintenance operations has been regarded as an occupational health risk. Blake, Charles L. etal., (2008).

Clutch Facings: Asbestos was utilized in clutches because it was heat and friction resistant, but it also produced dust that employees may breathe in. In most cases, the clutch discs can be put straight into the car. Historically, clutches have been included with other friction materials that contain asbestos, like brake pads and linings. For this reason, asbestos exposure during servicing of manual transmission clutches is not likely to result because of its ability to withstand heat, asbestos was frequently utilized in clutches and brake pads. However, when handling these parts, employees in the automotive sector, such as mechanics and brake repair specialists, run the risk of being exposed to asbestos. garage workers and auto mechanics.

Asbestos gaskets: Originally used to seal engine parts, asbestos gaskets also emitted fibers that might be harmful if ingested.

Heat Shields: Although asbestos was utilized in heat shields to shelter engine parts from high temperatures, doing so exposed workers to asbestos dust.

Brake Dust: Research has indicated that substantial concentrations of asbestos fibers can be found in brake dust from older cars with brake pads made of asbestos. Workers are seriously at risk for health problems from asbestos dust produced during the manufacturing of asbestos cement products. Karol Durczak and associates (2014),

Safe Option for Potential Asbestos Challenges

The asbestos since the brake pad slows down and stops the vehicle, it is the most important component of a braking system. Nagesh and associates (2014). Because of the increasing demand for automobiles worldwide, brake pads are in extremely high demand. Brake pads were previously made with frictional additives such as glue, asbestos, and other organic materials. However, in resolution the World Health

Organization declared asbestos materials to be carcinogenic. Neira etal., (2014). Because asbestos is so hazardous, researchers are looking into replacing it with materials including Kevlar, glass, metal, graphite, ceramics, agricultural waste, and natural ashes. They even created an asbestos-free brake pad using palm kernel shell (PKS). Elakhame etal., (2014).

Regulations: Guidelines for the safe handling and removal of products containing asbestos are among the restrictions the U.S. Environmental Protection Agency (EPA) has put in place to reduce asbestos exposure.

Safer Alternatives: To lower the hazards of asbestos exposure and major asbestos release, the industry is moving toward safer alternatives such as non-asbestos fibers and ceramic-based materials. Blake, Charles L. etal. (2008),

Management and Preventive Actions

The following are the management strategies and preventative actions for particular consequences of asbestos use in the automotive industry:

Workplace safety: implementing effective preventive measures, such as appropriate ventilation and personal protective equipment (PPE), is essential to shielding employees against asbestos exposure. Personal Protective Equipment (PPE): When handling materials that contain asbestos, workers should wear PPE, such as masks and gloves Karol Durczak et al., (2014)

Safe handling and disposal: Guidelines for the safe removal and disposal of asbestos are provided by laws and initiatives such as the national asbestos management plan in Australia and the "control of asbestos regulations" in the UK. The safe removal of asbestos-containing materials should be taken into consideration wherever feasible. However, since working with asbestos poses the highest risk of ACM exposure, it is crucial to provide safety and protection by confining any fibers that might be discharged during removal or cleanup. One of the most important things to take into account when creating a national strategy plan for the management of asbestos in Australia is the state of the ACM, which must be understood to ensure safe and efficient removal by the Australian Government, 2012. McCarthy etal., (2023)

Workers who are exposed to asbestos must take the proper precautions to reduce the hazards of asbestos fiber exposure. Gloves, protective suits, and HEPA filter masks are examples of personal protective equipment, or PPE. The health of employees must be protected by safety protocols such as wet asbestos removal, closed ventilation systems, and frequent employee training.

The Occupational Safety and Health Administration's (OSHA) asbestos regulation and the National Institute for Occupational Safety and Health's (NIOSH) asbestos measurement method, fibers with an aspect ratio (i.e., length to width) e" 3 and a length greater than 5 ìm must be counted. Rather than focusing on the most biologically significant fiber dimensions for risk prediction, this counting rule is primarily motivated by practical considerations about what might be quantified precisely and consistently with PCM. Stayner etal., December (2007).

Safe Handling and Removal: Approved techniques, such as negative-pressure enclosure/HEPA vacuum systems and low-pressure wet cleaning, should be used to handle and remove asbestos-containing objects.

Recent publications highlight the possible health hazards for both employees and customers as a result of asbestos use in the automobile sector. Older cars frequently employed asbestos-containing parts including gaskets, clutch facings, and brake pads, but when they wear down, they produce hazardous dust that can cause illnesses linked to asbestos exposure. Effective preventive measures are essential in the workplace to shield employees from asbestos exposure and associated health risks, according to research. Isabel Magdalena et al. (2013)

Frequent medical examinations: Regular health examinations are necessary for employees in the automotive sector to look for symptoms of illnesses linked to asbestos exposure. The fact that the general health check-up's focus has changed over time and its content is not well defined makes evaluating its function challenging. Often, a general health check-up is seen as a visit dedicated completely to preventive counseling and screening tests as part of screening programs.

Other words are also used, such as periodic health evaluation, preventative health examination, or annual physical. Omar Kherad et al. (March 2023)

Conclusion

This report emphasizes the significant health hazards linked to asbestos exposure as well as the consequences for the automobile sector. The industry must adopt safer alternatives and put in place efficient safety procedures since the use of asbestos in brake pads and other components poses a serious risk to human health. Researchers, industry professionals, and legislators can all benefit from the findings of this study regarding the necessity of safer procedures in the automobile sector.

Recommendations

The study's findings have led to the following recommendations:

Safer substitutes for asbestos in brake pads and other parts should be used by the automotive sector.

To reduce asbestos exposure, the industry should put in place efficient safety measures, such as ventilation systems and personal protective equipment.

To safeguard employees and customers, regulatory bodies must to encourage the adoption of safer substitutes and implement stringent safety regulations.

References

Boulanger, G., (2018). Asbestos Exposure and Mesothelioma: . . . . . *Journal of Environmental Health Sciences & Engineering*, 16(1), 1-11.

Berman, D. W., & Crump, K. S.(2008). A meta-analysis of asbestos-related cancer risk. Regulatory Toxicology and Pharmacology, 52(1), S26-S41.

Charles L. Blake, (2008), Evaluation of asbestos exposure within the automotive repair'industry: A study involving removal of asbestos-containing body sealants and drive clutch replacement, *Regulatory Toxicology and*

Pharmacology, Volume 52, Issue3,December 2008, Pages 324-331.

Dotson, Gary Scott, (2006), Characterization of asbestos exposure among automotive mechanicservicing and handling asbestos-containing materials". USF Tampa Graduate Theses and Dissertations. 5-7,15-20, https://digitalcommons.usf.edu/etd/2506

Elakhame, Z. U., Alhassan, O., & Samuel, A. (2014). Development and Production of Brake Pads from Palm Kernel Shell Composites. *International Journal of Scientific and Engineering Research*, 5 (October2014), 735744.g/ index.php/aujet/article/view/161/113

Hansen, E. S. (1989). "Mortality of auto mechanics." Scandinavian Journal of Work and Environmental Health 15: 43-46.

Kim, Y., (2019). Development of Asbestos-Free Brake Pads Using Alternative Materials. *Journal of Materials Science*, 54(10), 7445-7456.Am. J., (1935), Cancer Res. 24 (1), pp 56-64 View at publisher

Karol Durczak, (2014), Modern Methods of Asbestos Waste Management as Innovative Solutions for Recycling and Sustainable Cement Production, *Journals Sustainability* Volume 16 Issue 20 10.3390/su16208798

Leonel J. R. Nunes, (2024) The Use of Asbestos and Its Consequences: An Assessment of Environmental Impacts and Public Health Risks, *Journal/fibers*/12(12), 102; https://doi.org/10.3390/fib12120102

Leslie Stayner, (December 2007), An epidemiological study of the role of chrysotile asbestos fibre dimensions in determining respiratory disease risk in exposed workers, Occupational and Environmental Medicine 65(9):613-9 DOI: 10.1136/oem.2007.035584

Lemen, R. A. (2016). Asbestos in automotive brakes: exposure and risk. Journal of Occupational and Environmental Hygiene, 13(10), D141-D148.

McDonald, A.D., Fry, J.S., Woolley, A.J. and McDonald, J.C. (1984). "Dust exposure and mortality in an American

chrysotile asbestos friction products plant." British Journal of Industrial Medicine 41: 151-157.

Magdalena-Isabel Rosell-Murphy (2013) Risk factors associated with asbestos-related diseases: a community-based case–control study, BMC Public Health volume 13, Article number: 723,1-14J Public Health Res. (20 Dec, ... *Journal of Public Health*; 7(3):1519. doi: 10.4081/jphr.2018.1519

Neira, M. (2014). Chrysotile asbestos. In World Health Organisation (Vol. 203). https://doi.org/10.1007/978-3-540-72816-0_4401

Nagesh, S. N., Siddaraju, C., Prakash, S. V., & Ramesh, M. R. (2014). Characterization of Brake Pads by Variation in Composition of Friction Materials. Procedia Materials Science, 5(June2016), 295302.https://doi.org/10.1016/j.mspro.2014.07.270

Omar Kherad, (March 2023), General Health Check-Ups, European Journal of Internal Medicine, Volume 109, Pages 1-3

Rosemary, J. Korda, (2017), Risk of cancer associated with residential exposure to asbestos insulation: a whole-population cohort study, Volume 2,/pg e527. www.thelancet.com/public-health

Sakakibara and Uehara, (2006), Asbestos, Rock Miner. Sci., 35.1 (2006) (2006), pp. 3-10, 10.2465/gkk.35.3

Stayner, L. T., (2018). Asbestos Exposure And Lung Cancer: A Systematic Review and Meta-analysis. *Journal of Occupational and Environmental Medicine*, 60(5), 438- 445.

Stayner, l., T., (2018). Asbestos Exposure And Lung Cancer: A Systematic Review And Meta-Analysis. journal of occupational and environmental medicine, 60(5), 438-445.

Stayner, L., & Welch, L. S. (2014). Asbestos-related diseases. International Journal of Occupational and Environmental Health, 20(2), 141-153.

Timothy McCarthy (2023), Sustainable management of hazardous asbestos-containing materials: Containment,

stabilization and inertization, Science of The Total Environment, Volume 881, 10 July 2023, 163456

Teta, M. J., Lewinsohn, H.C., Meigs, J.W., Vidone, R.A., Moward. L.Z. and Flannery, J.T. (1983). "Mesothelioma in Connecticut: 1955-1977." *Journal of Occupational Medicine* 25(10): 749-756.

T.D. Oury, T.A. Sporn, V.L. Roggli (2014), Pathology of Asbestos-associated Diseases Springer (2014), pp. 217-230, 10.1007/978-3-642-41193-9