Austin Public Health

Open Access

Austin Publishing Group

Case Report

Asbestos Minerals in Consumer Products: A Well-Known Public Health Hazard Right in our Midst?

Haluza D*
Institute of Environmental Health, Medical University of Vienna, Austria

***Corresponding author:** Daniela Haluza, Institute of Environmental Health, Medical University of Vienna, Center for Public Health, Assistant Professor, Kinderspitalgasse 15, A-1090 Vienna, Austria

Received: September 22, 2016; **Accepted:** January 05, 2017; **Published:** January 06, 2017

Abstract

Asbestos minerals show unique physical properties such as sound absorption, resistance to fire, heat, and electricity. These desirable characteristics led to extensive use of asbestos in construction and domestic building materials. Due to the carcinogenic potential of asbestos fibers, asbestos and products containing asbestos have been banned or at least restricted in many countries. However, asbestos minerals are abundantly found in nature and thus, stone query products occasionally contain these potentially health hazardous fibers. This case report shows that commercially available gravel was contaminated with asbestos fibers. Macroscopic, microscopic and spectrometric evaluation revealed fibrous particles in the chippings consisting of chrysotile, tremolite, and actinolite. From a Public Health perspective, oddments of asbestos material in older buildings as well as query products encompassing asbestos are a slumbering health threat to consumers and workers alike. Given the indistinguishable exposure routes and also the long latency period of disease development, the individual risk might be considered as overall low. However, lessons learned from asbestos could provide guidance when introducing synthetic nano tubes resembling asbestos fibersand thus, provoking associated clinical conditions. This report highlights the need for further studies on safety of consumer products.

Keywords: Amphibole; Asbestos; Chrysotile; Mesothelioma; Airbornedust

Case Presentation

Problem statement

In Austria, an attentive consumer recognized conspicuous structures in gravel used for decorative purposes, e.g. in front gardens. As the competent authorities suspected that asbestos materials might be involved, this observation led to quality control-guide investigation of commercially available products by random sampling.

Background

Asbestos is the commercial name given to a group of six related polysilicate fibrous minerals that form very thin and flexible fibers [1]. The two fibrous silicates groups' serpentine (chrysotile) and amphibole (crocidolite, amosite, tremolite, anthophyllite, actinolite) are usually classified and regulated collectively as asbestos, although having different geologic occurrences and significant differences in crystalline structures and chemical compositions [2]. Variations in fiber structure and dimension as well as biopersistency lead to considerable differences in the relative potency for asbestos minerals causing disease in humans. Asbestos minerals also contain non-fibrous, and thus, nonpathogenic forms with similar or even identical chemical configuration. Asbestos fiber size and shape distributions vary between processes and operations. Previous studies suggest that long, thin fibers posea higher carcinogenic potency than shorter, wider fibers [3-5].

Asbestos minerals owe remarkable characteristics of extreme resistance to tensile strength as well as thermal and chemical breakdown. Thus, they have been widely used in industrial materials, including, automobile brake and clutches, vinyl asbestos floor, textured paints, and thermal insulation boards [6]. Abundant in nature, asbestos has been mined extensively for decades and worldwide, except in Antarctica.

By the mid-1960s, it was evident that all types of airborne asbestos fibers area serious Public Health hazard by causing non-cancerous diseases including asbestosis and pleural disease, but also malignant diseases such as lung, head and neck cancer [2]. Especially amphiboles are responsible for the occurrence of the rare, but hardly treatable and curable disease mesothelioma [7]. With 25 to 50-year latency, the ongoing mesothelioma epidemic associated with payment of compensations and costs of remediation measures is expected to peak around 2020 in Western Europe [8,9]. Though numbers of asbestos-caused malignant disease are underestimated due to non-reporting and difficulties in diagnosing, the global burden of mesothelioma occurrence in the years 1994-2008 was about 174,000 cases reported in 56 countries and estimated additional 40.000 unreported cases [10]. In Austria, incidence figures for the year 2012 reveal 116 mesothelioma cases [11].

Besides the well-known, specific occupational risk of mine workers and similar professions, the health hazards of domestic and environmental exposure to asbestos or asbestiform fibrous material is evident [12-14]. As an example, Maule et al. found elevated risks for mesothelioma in residents in the vicinity of an asbestos cement factory [15].

This case report evaluates the hypothesis that gravel for functional use such as road maintenance and decorative indoor and outdoor use

Citation: Haluza D. Asbestos Minerals in Consumer Products: A Well-Known Public Health Hazard Right in our Midst?. Austin Public Health. 2017; 2(1): 1007.

was contaminated with asbestos materials.

Method

Sample taking was performed according to and ordered by the public authority for product safety. To provide a nationwide coverage, gravel with grain size 2 to 4 mm sold in 25kg packages was obtained from anonymised large building supplies stores in five Austrian provinces in September 2008. Each package was filled into a plastic bowl for further exanimation wearing protective clothes including a mask. After thorough macroscopic assessment and photo documentation, subsamples these five product samples were further inspected. This was done using standard Polarized Light Microscopy (PLM), Phase-Contrast optical Microscopy (PCM), Scanning Electron Microscopy (SEM), and Energy Dispersive Spectrometry (EDS). Cleavage fragments show a relatively small length-to-width ratio, stepped sides, and splayed ends. So, they are distinguishable from asbestos fibers using microscopy or high resolution tools like SEM. The chemical composition of the fibers was analyzed using EDS.

Results

The five samples consisting of crushed stone showed similar macroscopic compositions regarding color and appearance. Also, fibrous, whitish material was distinguishable. The majority of the particulate material sized up to 4mm, with some single particles holding up to 9mm.

Microscopically, the main part of the crushed stone consisted of transparent to opaque serpentine with splintering sites of fractures, greenish color, and a dense and partly crystalline structure. All samples showed regularly distributed fibrous material with a color ranging from with to light green, appearing either long as well as filiform or short as well as felted. Single fibers were still connected with serpentine particulates.

According to the macroscopic and microscopic analyses, SEM identified the aforementioned fibrous, light green to white colored material as asbestos mineral belonging to the amphibole group. In the gravel samples, SEM-based analysis of fiber size and morphology as well as elemental composition using EDS detected both serpentine (chrysotile) and amphibole fibers such as actinolite and tremolite.

Discussion

This case report showed the contamination of gravel with asbestos fibers in consumer products commercially available in building supplies stores. Considering all data and information and EDS spectrum of the samples, the fibrous particles in the chippings consisted of chrysotile, tremolite, and actinolite. Systemic exposure to serpentine and amphibole asbestos fibers through respirable contact could cause negative health effects. Asbestos pollution from industrial sources greatly increases mesothelioma risk [16]. Thus, the findings provide evidence for a potential low-level environmental exposure to asbestos to the general public consuming unwittingly asbestos-containing products, as suggested by the literature [12,15,17,18].

Although the handling of asbestos is strictly regulated nowadays, there is a lack of awareness and understanding of its risk potential in the built environment versus the natural environment [17]. Mineral nomenclature, methods for particle analysis and sampling design must be accommodated to perform asbestos control, further complicated by newly identified amphibole asbestos minerals [19]. Recently new adjusted protocols for assessing asbestos-related cancer risk have been published, but they have to be evaluated considering their reliability for risk estimation [20]. However, crushed stone and processed ores may contain non-pathogenic mineral fragments that might be difficult to distinguish from asbestos.

The asbestos fibers found in the samples point toward neglecting precautionary measure related to mining, processing, and storage of ores [1]. Material from refilled joints should be avoided for gravel production. In these areas, tractive forces could probably produce fibrous components, as this characteristic shape is obtained by growth, not cleavage. Also, fine particulate matter should not be further processed after sieving of the cracked stone. Also fine material produced in the ongoing transport and recycling process should be eliminated immediately to avoid formation of respirable dust.

Regarding asbestos health risk assessment in environmental sciences, a reasonable threshold value is missing, as one single fiber could cause cancerous diseases of the peritoneum, the lung and various other organs. For this reason, industrial safety measures have to differ from consumer protection regulations. This case report on asbestos in gravel products highlights the possible risk of asbestos-associated diseases in stone quarries workers [2]. Asbestos is already banned in Austria and in many other countries worldwide. However, more research is needed to improve estimation of occupational and environmental exposures by fiber size and concentration in a variety of industries. Additionally, the detection of respirable fibrous particles in road maintenance and decorative material highlights the associated Public Health issues of exposure to this recognized carcinogen.

Asbestos in gravel products is of special interest as they are mostly used without protective equipment and handling instruction, resulting in environmental and human exposure especially when processed and minced mechanically [12]. Gravel spread on icy streets is pulverised by cars tyres during winter and elevated levels of airborne dust usually emerge when snow and ice melt. In addition to the negative effects on children's lung development of ambient air pollution children may inhale asbestos fibers when playing in gardens and gateways with asbestos-contaminated stone fragments [21].

Some weaknesses of this report need to be discussed. Firstly, this anecdotal description of evident asbestos occurrence shows methodological limitations, including lack of statistical sampling and inclusion of a small number of samples [22]. Secondly, no cause-effect relationship could be established and the results cannot be generalized to all gravel products. However, estimating the individual and Public Health risk is impossible without data on fiber concentration, amount and frequency of exposure [23]. Also, other research designs were not applicable in the respective case.

So, it might be considered as strengths that this report might help to generate novel study hypotheses to increase safety of consumer products. Asbestos is a recognized carcinogen and deposits of amphiboles throughout the country are not clearly defined. Thus, scientists, stakeholders, and public policy have to cooperate on the issue of protecting workers and the public with strict regulation concerning harmful exposure to asbestos, whether from asbestos waste or consumer products. To date, stone quarries and their products are not controlled on a regular basis, resulting in costly

recalls if accidentally contaminations with hazardous substances are detected. Quality management such as routine sample-taking and employee training are strongly recommendable to reduce occupational and Public Health hazards.

Outlook

Public Health professionals have to face nanotechnology as the key technology of the 21st century, with not yet assessable potential risks for men and the environment. Already existing evidence in animal experiments point toward an incredibly high risk of mesothelioma-like malignant diseases after contact with synthetic nano tubes similar to asbestos fibers [24,25]. In respect to the findings of this case report, health hazardous toxic substances with respirable size and fibrous shapes have to be kept away from consumer products in order to avoid man-made health disasters as experienced with asbestos.

Conclusion

Public concern was raised from a single consumer of certain gravel products. The analyzed samples contained fibrous components with size and shape properties to enter the human body via the respiratory tract. Thus, the expedient usage of pavement and gritting material could result in respirable fibrous particles, with potential negative health effects. Considering published data on asbestos material, the use of the tested products is not advised from environmental and occupational medicine aspects.

References

1. Cavariani F. Asbestos contamination in feldspar extraction sites: a failure of prevention? Commentary. Ann Ist Super Sanita. 2016; 52: 6-8.
2. Churg A. Chrysotile, tremolite, and malignant mesothelioma in man. Chest. 1988; 93: 621-628.
3. Dement JM. Workshop on fiber toxicology research needs. Environ Health Perspect. 1990; 88: 261-268.
4. Lippmann M. Asbestos exposure indices. Environ Res. 1988; 46: 86-106.
5. Panahi D, Kakooei H, Marioryad H, Mehrdad R, Golhosseini M. Evaluation of exposure to the airborne asbestos in an asbestos cement sheet manufacturing industry in Iran. Environ Monit Assess. 2011; 178: 449-454.
6. Kakooei H, Marioryad H. Evaluation of exposure to the airborne asbestos in an automobile brake and clutch manufacturing industry in Iran. Regul Toxicol Pharmacol. 2010; 56: 143-147.
7. Purdue MP, Jarvholm B, Bergdahl IA, Hayes RB, Baris D. Occupational exposures and head and neck cancers among Swedish construction workers. Scand J Work Environ Health. 2006; 32: 270-275.
8. Peto J, Decarli A, La Vecchia C, Levi F, Negri E. The European mesothelioma epidemic. Br J Cancer. 1999; 79: 666-672.
9. Sigsgaard T, Nowak D, Annesi-Maesano I, Nemery B, Toren K, Viegi G, et al. ERS position paper: work-related respiratory diseases in the EU. Eur Respir J. 2010; 35: 234-238.
10. Park EK, Takahashi K, Hoshuyama T, Cheng TJ, Delgermaa V, Le GV, et al. Global Magnitude of Reported and Unreported Mesothelioma. Environ Health Perspect. 2011; 119: 514-518.
11. Statistik Austria. Cancer incidence.
12. Bourdès V, Boffetta P, Pisani P. Environmental exposure to asbestos and risk of pleural mesothelioma: review and meta-analysis. Eur J Epidemiol. 2000; 16: 411-417.
13. Nelson G, Murray J, Phillips JI. The Risk of Asbestos Exposure in South African Diamond Mine Workers. Ann Occup Hyg. 2011; 55: 569-577.
14. Paget-Bailly S, Cyr D, Luce D. Occupational exposures to asbestos, polycyclic aromatic hydrocarbons and solvents, and cancers of the oral cavity and pharynx: a quantitative literature review. Int Arch Occup Environ Health. 2011: 1-11.
15. Maule MM, Magnani C, Dalmasso P, Mirabelli D, Merletti F, Biggeri A. Modeling mesothelioma risk associated with environmental asbestos exposure. Environ Health Perspect. 2007; 115: 1066-1071.
16. Dreassi E, Lagazio C, Maule MM, Magnani C, Biggeri A. Sensitivity analysis of the relationship between disease occurrence and distance from a putative source of pollution. Geospat Health. 2008; 2: 263-271.
17. Lee RJ, Strohmeier BR, Bunker KL, Van Orden DR. Naturally occurring asbestos - A recurring public policy challenge. J Hazard Mater. 2008; 153: 1-21.
18. Gordon RE, Fitzgerald S, Millette J. Asbestos in commercial cosmetic talcum powder as a cause of mesothelioma in women. Int J Occup Environ Health. 2014; 20: 318-332.
19. Oberti R, Ventura GD, Camara F. New Amphibole Compositions: Natural and Synthetic. Rev Mineral Geoch. 2007; 67: 89-124.
20. Berman DW. Apples to apples: the origin and magnitude of differences in asbestos cancer risk estimates derived using varying protocols. Risk Anal. 2011; 31: 1308-1326.
21. Gauderman WJ, Avol E, Gilliland F, Vora H, Thomas D, Berhane K, et al. The Effect of Air Pollution on Lung Development from 10 to 18 Years of Age. N Engl J Med. 2004; 351: 1057-1067.
22. Nissen T, Wynn R. The clinical case report: a review of its merits and limitations. BMC Research Notes. 2014; 7: 264.
23. Anastasiadou K, Gidarakos E. Toxicity evaluation for the broad area of the asbestos mine of northern Greece. J Hazard Mater. 2007; 139: 9-18.
24. Sakamoto Y, Nakae D, Fukumori N, Tayama K, Maekawa A, Imai K, et al. Induction of mesothelioma by a single intrascrotal administration of multi-wall carbon nanotube in intact male Fischer 344 rats. J Toxicol Sci. 2009; 34: 65-76.
25. He X, Despeaux E, Stueckle TA, Chi A, Castranova V, Dinu CZ, et al. Role of mesothelin in carbon nanotube-induced carcinogenic transformation of human bronchial epithelial cells. Am J Physiol Lung Cell Mol Physiol. 2016; 311: 15.

Austin Public Health - Volume 2 Issue 1 - 2017
Submit your Manuscript | www.austinpublishinggroup.com

Citation: Haluza D. Asbestos Minerals in Consumer Products: A Well-Known Public Health Hazard Right in our Midst?. Austin Public Health. 2017; 2(1): 1007.