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Health Risks and Environmental Concerns Associated with Asbestos - Cement Roofing Materials

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Abstract
The disposal of asbestos-cement waste resulting from roofing activities in diverse production facilities is recognized as a hazardous process that requires immediate and controlled removal from all impacted structures. Although the current approach involves the regulated disposal of these materials in designated areas, it falls short in adequately addressing the long-term environmental implications. This research provides a comprehensive examination of the current asbestos disposal practices in Kosovo, particularly focusing on the prevalence of asbestos-containing roofs in many residential buildings. By analyzing a range of scholarly sources, this study explores prevalent strategies for the neutralization, reuse, or recycling of these harmful materials that pose risks to both human health and the environment. The findings highlight that thermal and chemical treatments are the predominant methods employed for managing asbestos-cement waste. Despite the established effectiveness of these techniques in recycling asbestos-cement products, the existing legal framework is ambiguous and may hinder the practical application of these methods.

Keywords
Hazardous materials, Controlled removal, Construction facilities, Environmental impact, Kosovo

INTRODUCTION

Asbestos fibers pose a significant health risk when inhaled, leading to various illnesses. Asbestos-cement materials have been widely utilized across numerous industries, with the construction sector being the primary area of application. These materials have been commonly used in roofing, water supply pipes, facades, floors, ceilings, and various other applications. Despite arguments advocating for the safe use of chrysotile, or white, asbestos in specific scenarios, multiple studies have demonstrated that all types of asbestos, including mesothelioma, are carcinogenic [1]. The World Health Organization (WHO) estimates that annually, 125 million individuals worldwide are exposed to asbestos in the workplace, with over 107,000 people succumbing to asbestos-related diseases each year [1]. A study conducted in 2021 examined the correlation between mesothelioma mortality and asbestos exposure in various countries, revealing a rise in asbestos-related illnesses with continued asbestos use [2]. The World Health Organization (WHO) advocates that ceasing mineral extraction and usage is the most effective strategy to combat these diseases. Recent years have seen China, Brazil, and Russia emerge as the primary asbestos manufacturers. However, Brazil implemented an asbestos ban in 2017. Global consumption of unmanufactured asbestos fiber decreased significantly from around 2 million tons in 2000 to an estimated range of 1.1 to 1.3 million tons annually from 2015 to 2021. The ongoing demand for asbestos is expected to persist, particularly in Asia for its application in cement pipes, roofing sheets, and various construction materials. In November 2017, Brazil's Supreme Federal Court enforced a nationwide asbestos ban. Despite a brief interruption in 2021 due to a legal issue, the sole asbestos manufacturer in the USA has been consistently operating its mine since November 2020 under state law, allowing asbestos extraction and processing in the State of Goias solely for export purposes. In August 2019, a Zimbabwean company extracted asbestos from previous mine tailings, yielding an average monthly output of 500 tons. Plans were made in 2020 to resume operations at the King Mine in Mashava and the Shabanie Mine in Zvishavane; however, as of 2022, there is no information on the status of asbestos production from tailings, with indications that financial constraints hinder the resumption of mining activities. Despite over 60 countries prohibiting asbestos-containing

products, countries like Russia, Kazakhstan, and China continue their asbestos manufacturing operations. According to the US Geological Survey (USGS), the production of asbestos fibers by mass in 2022 is projected to reach approximately 1,330.00 Mt as presented in Table 1. [3].

Table 1 Asbestos: world production, by country or locality1, 2 [1]

Country or locality	2018	2019	2020	2021	2022
Brazil	101,000	12,205	77,057	153,600	197,100
Chinae	120,000	140,000	130,000	130,000	130,000
Kazakhstan	202,900	210,700	227,400	250,100	250,100
Russia	752,917	790,000	708,000	750,000	750,000
Zimbabwe	--	2,500	8,000	--	--
Total	**1,180,000**	**1,160,000**	**1,150,000**	**1,280,000**	**1,330,000**

Table 2 U.S. Geological Survey, Mineral Commodity Summaries, January 2023 [2]

	Mine production		
	2021	2022	Reserves
United States	-	-	Small
Brazil	154,000	190,000	11,000,000
China	130,000	130,000	15,000,000
Kazakhstan	250,000	230,000	Large
Russia	699,000	700,000	110,000,000

The situation related to the production and use of "ASBEST" in Kosovo

Numerous producers in Kosovo manufacture an extensive range of asbestos prod-ucts, with one facility specializing in asbestos cement products primarily utilized for roofing and other applications. Asbestos compounds are present in many of these facili-ties and are employed in various capacities, such as water pipes, roof covers, and other commonly recognized items. Despite the ban on asbestos-based product manufacturing in Kosovo, there has been limited progress in systematically replacing or disposing of exist-ing materials. While projects have been proposed, their execution has been constrained. In 2019, an initiative aimed at cleaning the Lepenc River was undertaken. Unfortunately, the accumulated asbestos debris from the river was not properly disposed of or secured; in-stead, it was dispersed, leading to contamination in neighboring areas. It is crucial to note that any mechanical damage or improper handling of asbestos waste due to incorrect us-age can result in significant harm. It is important to emphasize that when asbestos is used correctly, it does not pose a risk. One hazardous material containing asbestos is the roof-ing product made of asbestos cement (Figure 1), which remains prevalent in many homes in the Municipality of Pristina and other municipalities across Kosovo. This material has also been used in various public facilities such as schools, hospitals, and administrative buildings. The extensive use of asbestos prompted the Municipality of Pristina to launch the "Prishtina without asbestos" campaign [6]. The initiative aimed to systematically re-move all asbestos cement roofing from homes and replace them with new roofs, incorporating the installation of solar panels. The accompanying image depicts a community in Pristina, Ulpiana, where almost all residential homes feature roofing products made of asbestos cement.

Fig. 1 Buildings in Pristina covered with asbestos cement

Fig. 2 Coverings from asbestos cement

Disposal of asbestos products in Kosovo

At present, Kosovo faces various socioeconomic challenges that require immediate attention and resolution. These challenges extend beyond deserts and water shortages to encompass environmental issues, nuclear and terrorist threats, and the proper disposal of hazardous asbestos materials. Given the widespread use of asbestos, it is crucial to reduce and dispose of these materials in a responsible manner for the well-being of humans and other living organisms. Currently, the most acceptable method of disposing of asbestos containing materials is by depositing them in designated hazardous waste dumps or specific sections of landfill sites. However, it is important to note that the criteria for waste prevention,

minimization, and reuse vary across different countries and regions [7], [8]. Asbestos disposal practices vary internationally, with experts actively working on devel-oping the most effective strategies for asbestos waste disposal. Storing asbestos waste is generally regarded as a temporary solution. For example, Japan advocates for the monetization of asbestos waste through thermal processing [9], [10]. Although research on recy-cling solutions for asbestos waste is ongoing, practical implementation is hindered by high costs and specific laboratory requirements [11]. The studies conducted by Gidarakos et al. [12] and Paglietti et al. [13], proposing the repurposing of asbestos mines for asbestos waste disposal in the future as a secure method to minimize environmental harm, hold significant importance. Asbestos waste is categorized as hazardous, necessitating specialized strategies and rigorous management. Environmental safety protocols in Kosovo are implemented in compliance with mandatory regulations, encompassing waste control plans at the national, regional, and local levels [14]. Property owners are mandated to register asbestos products for removal and disposal in a designated territorial management unit. However, the primary obstacle, as previously mentioned, relates to the financial aspect, with property owners responsible for all costs associated with eliminating asbestos roofing, including asbestos panels, and replacing them with safer materials. To expedite the removal process and protect the environment from the risks posed by improper asbestos waste management, guidance from local government authorities is essential. This support may also involve financial aid for asbestos removal, transportation, and waste disposal generated during the dismantling of hazardous production particles and scrap metal in industrial facilities or private residences. These stringent regulations aim to mitigate adverse effects on human health, particularly for individuals concerned about the removal process. The global estimate indicates that approximately 125 million people are vulnerable to exposure to hazardous asbestos in their work environments, resulting in a significant number of annual cases of asbestos-related diseases. Remarkably, Kosovo is the lone country in the European Union that has yet to initiate the treatment, disposal, or recycling of asbestos-related products in accordance with the local laws and administrative guidelines. As a result, areas where this substance was deposited have been directly contaminated. The dismantling of structures containing asbestos cement has occurred without the implementation of adequate safety measures, and the locations for disposing of these materials remain undetermined. For instance, on November 19, 2021, the Public Housing Company removed asbestos cement (see Figure 3).

Fig. 3 In "Lakrishte" several NPB buildings are destroyed
(https://www.koha.net/en/metro/290960/In-Lakriste%2C-several-buildings-of-the-National-Museum-of-Natural-History-are-destroyed/)

The decommissioning process, as depicted in the provided image, was carried out without implementing sufficient protective measures or safeguarding precautions. The demolition procedure was executed using heavy equipment. Given the facility's proximity to a secondary school where educational activities were ongoing during the dismantling of asbestos-cement-covered homes, all relevant laws and administrative directives concerning the handling of hazardous materials were strictly observed. According to the data provided by the Kosovo Statistics Agency (ASK), not a single asbestos product has been recycled from 2019 to 2022. During the same period, a total of approximately 52,793 other substances were recycled, as indicated in Tables 3 and 4. Moreover, the total amount of various waste materials generated from 2019 to 2022, as presented in Table 2, was ap-proximately 1,871,818.1 tons.

Table 3 Waste treatment in Kosovo by type by waste, variabla and year [3]

Waste treatment in Kosovo by type by waste, variabla and year					
		2019	**2020**	**2021**	**2022**
Hospital waste	Recycled	:	968.0	:	:
Paper and cardboard waste	Recycled	248.0	304.0	11361.0	10839.0
Scrap metal waste	Recycled	2479.0	1284.0	3042.0	3524.0
Plastic waste	Recycled	1027.0	2294.0	6904.0	8519.0
Waste from households and the like	Recycled	:	:	:	:
Total	Recycled	22882.0	21307.0	4850.0	3754.0

Table 4 Waste treatment in Kosovo by type by waste, variabla and year [3]

Waste treatment in Kosovo by type by waste, variabla and year					
		2019	2020	2021	2022
Hospital waste	Disposed	:	:	:	:
Paper and cardboard waste	Disposed	:	:	:	:
Scrap metal waste	Disposed	:	:	:	:
Plastic waste	Disposed	:	:	:	:
Waste from households and the like	Disposed	445547.0	445449.0	483777	497045.0
Total	Disposed	445547.0	445449.0	483777	497045.0

This study aims to identify effective strategies and explore opportunities for recycling asbestos-cement products, which have become a pressing environmental and health concern. The assessment includes all known methods of recycling asbestos-cement products, as well as techniques for disposing of this hazardous material in a safe and responsible manner. The "Program Prishtina without Asbestos and other initiatives" have played a significant role in outlining activities related to the removal and neutralization of asbestos products, with the goal of minimizing their negative impact on the environment. These activities will be carried out at both the central and municipal levels. Given the prevalence of asbestos-cement in Kosovo, there is a considerable amount of asbestos-cement waste present, with more than 80% of homes built before the 1990s featuring asbestos-cement roofing.

Additionally, many municipalities rely on asbestos cement pipes for water distribution. It is important to note that this figure does not include the total amount of existing waste, as asbestos is present in various other materials, and there are numerous unidentified dumps of this substance. This study aims to investigate and evaluate advancements in asbestos protection, recycling, and safe disposal, with a focus on eliminating asbestos products in Kosovo at a local level. The research examines the factors contributing to the presence of asbestos in Kosovo, including historical circumstances such as the different phases of asbestos utilization in the national economy, manufacturing, and industry. In addition to financial constraints, the impact of the First and Second World Wars on Kosovo's asbestos removal and neutralization efforts continues to be explored. After the conclusion of the conflict in Kosovo in 1999 and the declaration of independence in 2008, the region promptly initiated measures to address asbestos-related issues. These measures in-volved formulating regulations and administrative directives concerning hazardous mate-rials, including asbestos. This paper discusses the ongoing efforts to align these regulations and administrative directives for handling hazardous materials with those of the European Union. Kosovo has not only compiled these regulations and directives but has also taken steps to harmonize them with European standards.

The following legislation and regulations have been implemented in Kosovo to ad-dress asbestos-related issues:

- Law no. 04.l - 060 for waste;
- UA (MEA) - No. 01/2020 on Waste Management Containing Asbestos;
- Regulation (MPMS) - No. 07/2017 for the Protection of Employees from Risks Related to Asbestos Exposure at Work;
- Regulation (MPMS) No. 02/2021 on Workplace Risk Assessment.
- UA (QRK) - No. 03/2021 for Hazardous Waste Management;
- UA (MESP) - No. 02/2017 for the List of Hazardous Waste Categories by Origin.
- Law No. 03/L–025 on Environmental Protection;
- Law No. 03/L–233 on Nature Protection;
- UA (QRK) - No. 08/2017 of Landfill Management;
- Law No. 03/L–214 on the Environmental Impact Assessment.

The primary objective of this research was to investigate the following questions:

1. What were the scope and nature of changes in asbestos usage in Kosovo throughout the course of the 20th century?
2. What is the known quantity of asbestos in Kosovo, and how does it differ across var-ious locations?
3. Is there a relationship between the documented amount of asbestos and the quantity requiring removal?
4. Does this relationship align with the level of urbanization, specifically the percent-age of urban residents?
5. Furthermore, is there a connection between the officially recorded quantity of asbestos, the remaining amount needing removal, and the total number of structures constructed between 1970 and 1988, a period during which asbestos was commonly used in construction and engineering?

METHODOLOGY AND DATA SOURCES

The study relied on a variety of sources, including academic papers, official plans, strategies, and public documents to gather essential information for assessing the asbestos situation in Kosovo. Moreover, interviews were conducted with experts and individuals affected by asbestos exposure to gain a more comprehensive understanding of the issue. The organization compiled data from multiple documents, including those from the Ministry of Environment and Spatial Planning and other relevant agencies, to offer a detailed overview of asbestos containment and its associated social and environmental management plans. Documents such as 'Identification of the Challenges of the Area 2018,' the City of

Pristina, 'Action Plan for the Green City 2021,' 'Strategy of the Republic of Kosovo for Waste Control 2013-2022,' 'Environmental and Social Control Plan for Asbestos Waste,' and 'Prepared for Rehabilitation Work within the Radoniqi-Dukagjini Irrigation Program, Asbestos-free Prishtina in Kosovo from 2023' were meticulously reviewed. However, discrepancies were identified during the analysis, indicating inconsistencies between the identified asbestos locations requiring immediate removal in the documents and the actual data in the data-base, raising concerns about reliability. Therefore, a thorough investigation is crucial to ad-dress these discrepancies effectively.

The study also highlighted a knowledge gap among rural property owners regarding asbestos handling and disposal, emphasizing the need for government agencies to provide adequate education and resources in these areas. Despite classifying asbestos removal as "very urgent" in most Kosovo cities and developing waste control plans, practical actions have not been fully implemented. Various authors of the reviewed documents proposed different strategies for qualification, processing, and outcomes related to asbestos presence and removal procedures. The methodology involved four main phases: field study, laboratory analysis, interpretation of results, and document evaluation, as depicted in the flowchart shown in Figure 4.

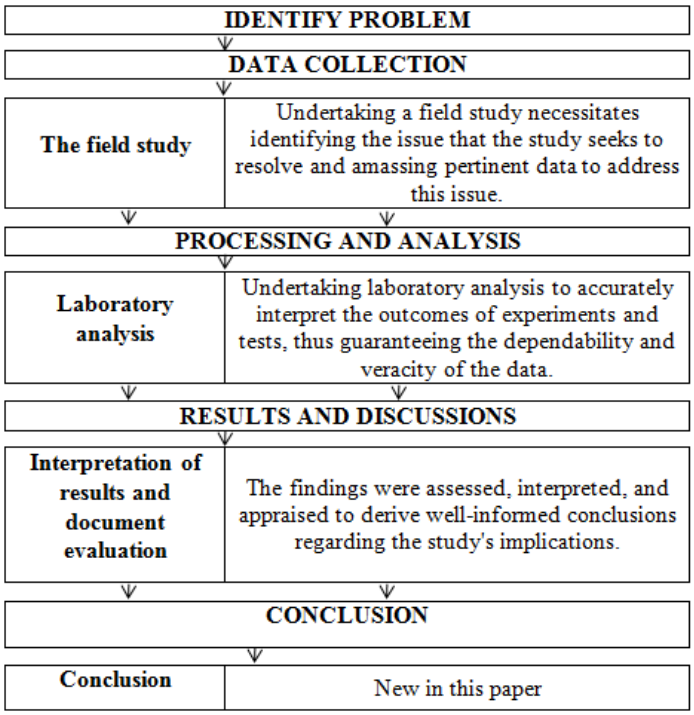

Fig. 4 Flowchart of the methodology

Asbestos Disposal Process

Prompt removal of damaged asbestos from buildings and homes is of paramount importance, leading the Republic of Kosovo to establish stringent regulations across its ministries and municipalities. These guidelines provide recommendations and directives for the proper management of asbestos. However, the collection, storage, and disposal of asbestos waste in Kosovo face significant obstacles, primarily due to the substantial dis-parities between the European Union guidelines presented in Brussels on September 28, 2022 (COM (2022) 488 final), and the existing regulations in the Republic of Kosovo. Given the airborne dangers of asbestos, the Environmental Protection Agency (EPA) has implemented regulations addressing air pollutants to minimize the risk of public exposure. Nevertheless, Kosovo grapples with finding and training certified professionals and specialized teams or organizations, compounded by the absence of a dedicated commitment in this area. To mitigate the risks associated with asbestos exposure, it is vital to reduce asbestos, identify hazards, and correctly remove toxins and other residues [18]. This pro-active approach is crucial for preventing the excessive health risks that asbestos poses to people, nature, and surroundings.

Recycling Asbestos

Several studies have been conducted to explore coping strategies for asbestos post-removal, given the scarcity of landfill space. Various experiments have investigated recycling asbestos, which could result in cost and space savings. In a study conducted in Italy, researchers utilized a mechanochemical transformation method to recycle chrysotile and amphibole asbestos into a new amorphous material, stabilizing the waste for safe re-use. The mechanochemical technique, involving a chemical reaction through grinding, alters a substance's overall structure by breaking down its chemical bonds. In this study, researchers ground diverse trash samples containing asbestos using a high-velocity mill, effectively disintegrating the asbestos fibers. Analysis of the samples revealed the complete transformation of asbestos into an amorphous state in as little as four minutes [19].

Another investigation examined the recycling of asbestos from contaminated materials, particularly metals, using a sodium hydroxide bath to prevent airborne fiber releases. The resulting solid residue and asbestos waste may be melted

at high temperatures to produce glass or glass-ceramic, which are non-toxic and reusable materials. Recycling asbestos offers an opportunity to conserve resources and decrease the risk of landfill contamination. However, it is crucial to emphasize that these techniques should not be at-tempted independently. Asbestos removal and disposal must be undertaken by specialized professionals. The Environmental Protection Agency (EPA) recommends wetting asbestos containing materials before sealing them in a leak-proof field with proper labeling. Transport vehicles carrying asbestos for disposal must be marked and adhere to strict waste recordkeeping protocols. Landfills that handle asbestos frequently allocate designated areas for asbestos waste storage, ensuring complete safety and preventing leakage into the air or soil, a process that poses a significant source of annoyance [20].

The safe handling of asbestos is of paramount importance due to the potential dangers it poses to workers and the general public when mishandled. In Kosovo, the instances of asbestos cement removal are severely limited and often carried out by non-experts who lack vital records. This is exemplified by the removal of asbestos cement covers depicted in image four, a situation that is not only unacceptable but also reprehensible. Such actions contradict all the regulations and administrative commands presently enforced in Kosovo, further exacerbated by the proximity of the college building situated 20 meters from the removal site. Asbestos exposure can lead to serious health problems, including mesothelioma, lung cancer, and asbestosis. While these disorders are treatable, there is currently no cure, which is why strict regulations exist in Kosovo to protect workers and the public. Unfortunately, these regulations are not consistently implemented, and there is a shortage of experts and specialized companies equipped to handle asbestos safely [21]. The purpose of imposing fines and penalties for breaching asbestos laws is to deter non-expert individuals and businesses from attempting to remove asbestos-containing products independently. It is crucial that projects involving asbestos are carried out by qualified and experienced entities that have the necessary expertise to comply with the relevant rules and regulations [22]. These entities should also encourage and advise business owners and other organizations to comply with the pertinent guidelines and standards.

Asbestos waste treatment methods

There are four fundamental strategies for eliminating asbestos fibers and various intermediate forms.

1. Thermal methods: These methods rely on the decomposition of asbestos at high temperatures (making it no longer harmful). Ovens, plasma torches, and microwave radiation are some of the methods used to remove asbestos. The process can be expedited and operated at a lower temperature by adding clay or chemicals.
2. Chemical techniques: It is also feasible to remove asbestos fibers using chemicals. There are several strategies for dealing with acids and bases. This process can be expedited by increasing the temperature and/or pressure (certain chemical processes generate heat and require cooling). Often, additional use is the capacity to use organic waste, industrial waste acids, or collected CO2.
3. Mechanical techniques: Asbestos fibers can be broken down by coarse grinding. Special high-energy mills are employed for this purpose, causing not only physical, but also chemical and physicochemical transformations to produce an extremely fine, non-toxic powder.
4. Biological techniques: Finally, fungi and bacteria have been shown to be capable of breaking down asbestos. This occurs naturally but slowly. Under the correct conditions, this process can be significantly accelerated. For the time being, it has been proven that loose threads of chrysotile asbestos can be broken down in this manner [26, 27].

RESULTS

The benefits of recycling asbestos cement are numerous, including the following:

1. Hazardous fibers are effectively broken down and transformed into non-hazardous materials, which reduces the risk of harm to humans and the environment.
2. The final products of recycling can be repurposed in a variety of ways, contributing to a more sustainable and circular use of resources.
3. Extensive volume reduction is achieved through recycling, thereby conserving valuable space in the environment that would otherwise be taken up by disposal.
4. Environmental contamination is prevented by keeping asbestos out of landfills, which protects workers from exposure and ensures safe disposal practices.
5. Cost savings are realized through the recycling process, which reduces expenses associated with disposal.

It should be noted that the advantages of recycling asbestos cement are not limited to the specific techniques used in Kosovo, but apply universally to the practice of recycling this material [23]. The production of recycled items has not only alleviated economic strains, but it also offers a secure alternative for usage in areas where the extraction, safe-guarding, and disposal of hazardous waste materials pose significant threats to both hu-man health and the environment [24, 25]. Presently, the cost of recycling asbestos is nearly three times that of its standard disposal. Although some expenditures can be recuperated by selling non-hazardous end products, the general public in the United States is prohibited from recycling asbestos. Historically, the Department of Defense treated asbestos at the Savannah River Site, which is situated near Aiken, South Carolina. Private enterprises are actively engaged in the development and enhancement of asbestos recycling techniques to make it more cost-effective in the near future. Asbestos recycling is a

safer method of disposing of asbestos-containing materials, as it reduces the reliance on a dwindling number of regulated disposal sites. Consequently, asbestos recycling is anticipated to become increasingly significant in the near future.

DISCUSSION

This study provides vital insights into the significant challenges surrounding asbestos consumption, disposal, and management in Kosovo. The assessment of asbestos-related issues in the region reveals pressing concerns that necessitate prompt attention and strategic solutions.

A key aspect highlighted in the study is the historical patterns of asbestos consumption in Kosovo during the 20th century. Understanding the extent and shifts in asbestos use is critical for developing effective strategies for asbestos removal and containment. The data gathered from various sources indicates a substantial presence of asbestos in Kosovo, particularly in older structures built before the 1990s. This poses a significant health and environmental risk that needs to be addressed promptly.

The relationship between the reported quantity of asbestos and the actual amount requiring removal underscores the urgency of implementing comprehensive asbestos management plans. The study also raises questions about the relationship between asbestos quantities, urbanization levels, and the construction boom between 1970 and 1988. This period of extensive asbestos use in construction emphasizes the need for targeted interventions to address the legacy of asbestos-containing materials in buildings and infra-structure.

Furthermore, the challenges associated with asbestos disposal and the lack of systematic replacement strategies for existing asbestos materials in Kosovo are pressing is-sues that demand immediate action. The ineffective handling of asbestos waste, as evidenced by the contamination of the Lepenc River, highlights the need for stringent regulations and enforcement mechanisms to ensure proper disposal practices.

The deficiencies detected in existing documents and plans related to the management of asbestos underscore the significance of carrying out comprehensive investigations and implementing corrective actions. It is essential to bridge the knowledge gaps among rural property owners and enhance public awareness about safe handling and disposal of asbestos to reduce the risks associated with exposure.

In summary, the results of this study highlight the necessity for collaborative efforts at the national and local levels to confront the challenges posed by asbestos-containing materials in Kosovo. By implementing inclusive asbestos management plans, raising public awareness, and enforcing stringent regulations for asbestos disposal, Kosovo can mitigate the health and environmental hazards linked to asbestos exposure and create a safer living environment for its inhabitants.

Research Highlights

1. Environmental and Health Concerns: Asbestos cement waste is prevalent in various construction centers, posing significant environmental and health hazards, despite current disposal techniques. Our study is focused on asbestos disposal in Kosovo, particularly in Pristina, where many buildings still have asbestos roofs.
2. Current Disposal Techniques: Thermal and chemical treatments are common techniques for neutralizing, reusing, or recycling asbestos-cement waste. However, the le-gal policies surrounding these methods are unclear and may impede their practical implementation.
3. Disposal Situation in Kosovo: Asbestos waste management poses challenges in Kosovo, with limited implementation of disposal regulations and inadequate attention among property owners. The disposal process relies on different waste dumps, with limited recycling efforts.
4. Benefits of Recycling: Recycling asbestos-cement products offers several ad-vantages, including breaking down hazardous fibers, reducing the volume, and preventing environmental contamination. While recycling may incur higher initial costs, it offers long-term cost savings.
5. Recycling and Neutralization Strategies: Analysis of various literature sources and current methods for neutralizing, reusing, and recycling asbestos waste, with a focus on thermal and chemical treatments.
6. Regulatory Challenges: Discussion of the legal policies surrounding asbestos disposal in Kosovo and the uncertainties and obstacles posed by present laws, hindering the practical application of safe disposal and recycling strategies.
7. Environmental and Health Implications: Examination of the environmental and health risks associated with improper asbestos disposal highlights the urgent need for safe and effective techniques to mitigate these risks and protect public health and the environment.

CONCLUSIONS

Based on the analysis of asbestos disposal strategies in Kosovo, it is crucial to implement new financial mechanisms to support the removal of asbestos materials. The lack of adequate financial resources is a major barrier to the effective implementation of asbestos disposal strategies in Kosovo, and it is essential to address this issue by developing innovative solutions. Furthermore, raising awareness among local authorities, communities, and business owners about the adverse effects of asbestos use is critical. Additionally, promoting the development and implementation of safer and more sustainable alternatives to asbestos is necessary to reduce its impact on human health and the environment. A comprehensive approach that focuses on safe disposal practices, explores potential re-cycling opportunities, and aligns

with European Union regulations is essential in tackling the challenges posed by asbestos consumption. The need for education and awareness campaigns to inform individuals and businesses about the dangers of asbestos exposure is crucial. It is important to adopt safe disposal methods and explore potential recycling options while also aligning with the regulatory standards established by the European Union. Although progress has been made in formulating rules and guidelines for handling hazardous materials like asbestos, there is still work to be done to achieve the goals of asbestos removal programs in Kosovo. To meet the goals of asbestos removal programs, continued efforts are necessary to develop and implement effective strategies for handling hazardous materials, including asbestos. Addressing asbestos-related issues and safe-guarding public health and the environment requires ongoing efforts.

DECLARATIONS

Author Contributions

Conceptualization: Mu.A and M.S.; methodology, M.S.; formal analysis, Mu.A.; investigation, Mu.A; data curation, Mu.A; writing—original draft preparation, Mu.A. and M.S.; writing—review and editing, Mu.A.; visualization, M.S.; supervision, M.S.; funding acquisition, M.S. All the authors have read and agreed to the published version of the manuscript.

Data Availability Statement

The data presented in this study are available in the article.

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Conflicts of Interest

The authors declare no conflict of interest

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