



THE UNEP DOCUMENT ON ASBESTOS CONTAMINANTS

AN ANALYSIS BY THE
**INTERNATIONAL CHRYSOTILE
ASSOCIATION**

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INTRODUCTION

In late February 2024, a paper titled "[Options for addressing asbestos contaminants in products and the environment](#)"¹ was distributed as an information document to the participants to the 6th session of the United Nations Environment Programme (UNEP)'s UN Environment Assembly (UNEA-6), which was held in Nairobi, Kenya, between February 26th and March 1st, 2024.

The 24-page document (hereinafter the 'UNEP document') was produced by the UNEP, in cooperation with the World Health Organization (WHO) and with input from the International Labour Organization (ILO), following a demand included in Resolution 5/7 adopted by the Fifth Session of the United Nations Environment Assembly UNEA-5) in 2021.





This document is a first as its scope goes beyond the usual focus on asbestos-related occupational and public health issues, to include potential environmental impacts. The coverage note by the UNEP Secretariat claims that it was intended *'to provide an overview of the foundational knowledge of asbestos, including its adverse impacts on human health and the environment, and the material flows along the life cycle.'* However, its authors somewhat mitigated their ambitions by expressly acknowledging that *'[t]he paper does not encompass an exhaustive review of all available information and references but is a summary of a rapid review'*².

Indeed, the International Chrysotile Association (ICA)'s review of the UNEP document reveals that its fancy presentation and extended scientific references also serve to hide serious fallacies and misrepresentations and that, contrary to its own title, it promotes just one single option to address the issue of asbestos contaminants: a worldwide ban of all form of asbestos.

It should be noted that the document was released in English only and not until a week before the start of UNEA-6, thus contravening to Rule of Procedure 12.3 whereby the Assembly can only include in its Agenda items duly communicated 42 days before the session in order to allow for proper review by all participants.

The present ICA analysis succinctly reviews the UNEP document's numerous shortcomings. Its first section provides an assessment of key issues that fundamentally skew the authors' approach and appraisals. The second section highlights specific issues that exemplify the depth and potential impacts of those approximations on the document's overall credibility and usefulness.

¹ <https://documents.un.org/doc/undoc/gen/k24/003/25/pdf/k2400325.pdf>

² Second paragraph of the document presented as an Annex to the Note by the UNEP Secretariat (part: 'About the document', Annex: page 2).



SECTION 1
**OVERALL
REVIEW**



1.1 - A FUNDAMENTAL BIAS

Up until now, the issue of asbestos has traditionally been addressed by various UN bodies as an issue of public health and of occupational safety. The UNEP document represent a first, as it attempts to update it as an issue of environmental hazard, through the prism of its impact on public health.

In view of this unprecedented nature of the UNEP document, the ICA finds especially worrisome that it was not able to trace the origin of the specific discussions that led to the addition of the demand to the list of requests grouped together in Resolution 5/7 voted by the 2021 UNEA-5; that no recognized independent experts or country representatives were involved with the document's preparation and; that the specific roles and contribution of its various authors remain unclear.

More fundamentally, the ICA finds particularly disturbing that throughout the document, produced with cooperation from the WHO, the UNEP choses to ignore not only a considerable amount of recent scientific research but also

the [2007 World Health Assembly's resolution 60/26](#) that calls for a 'differentiated approach' of the various asbestos forms when designing national campaigns to address asbestos-related diseases³.

Ignoring scientific facts and a previous UN sanctioned position emanating from the WHO's own governing body, the authors instead deliberately base their whole analysis on the provenly erroneous premise that all asbestos fiber types (amphiboles and chrysotile) could equally cause diseases. For a document pretending to provide the foundational knowledge on asbestos, it is to say the least puzzling and casts serious doubts about its quality and scientific robustness.

From the ICA's perspective, this fundamental distortion, which provides the basis for the entire document, should in itself suffice to completely discredit it.

³ See: https://apps.who.int/gb/ebwha/pdf_files/wha60/a60_r26-en.pdf, paragraph 10. Last consulted March 2025

1.2 - CONFUSION BETWEEN HAZARDS AND RISKS

In a similar vein, it must be noted upfront that the document as a whole is marred by the unfortunately common lack of differentiation made by its authors between hazards and risks.


As the prism of public health is central to the UNEP document, readers should bear in mind that the International Agency for Research on Cancer (IARC), which is part of the WHO, classifies substances and habits as carcinogens based on some studies and conclusions about the certainty of their hazardousness, not their health risks. The WHO, through IARC, does not make any risk assessment, i.e. it does not make any evaluation of the possibility that a source of danger (hazard identification) turns into a harm. For this reason, different sources of danger such as tobacco, solar radiation, outdoor pollution, vinyl chloride, alcoholic beverages, wood dust, are all classified in the same Category 1 of carcinogenic products as all type of asbestos fibers. Risk management is dealt with by national governments through a myriad of measures such as information campaigns, consumer protection rules, or other, more restrictive, measures.

By again ignoring this fundamental fact, the UNEP document unfortunately contributes to further obfuscate issues while pretending to clarify them.

The two major distortions outlined above should have been sufficient to mandate a thorough, science-based and fact checked review of the UNEP document before its distribution.

Regrettably, the ICA's perusal of its "findings" on the impact of asbestos on human health and on the environment, of its socio-economic effects and life cycle, of existing regulations and - last but not least - on the existence of apparently safer alternatives brought to light numerous other flaws and fallacies. While professing to offer options, the use and misuse of references that pepper the document inevitably lead to the conclusion that the only realistic one is the banishment of all forms of asbestos. It is as if the whole document was constructed with this sole objective in mind.

While far from being exhaustive, the following section highlights some of the most blatant misconceptions and errors that further discredit the UNEP document.



SECTION 2
SPECIFIC
ISSUES

2.1 – THE EFFECTS OF ASBESTOS ON HUMAN HEALTH

Being the prism through which the whole document examines the various impacts of asbestos use, the way health-related issues are addressed in the UNEP document deserves attention. The ICA has produced a more detailed analysis of this specific issue which includes supplementary data. It can be consulted in the Addendum to the present document. The following paragraphs highlight its most important aspects.

An uninformed reading of the key findings that open the UNEP document creates a dire portrait. The statement to the effect that “[G]lobally, in 2016, occupational exposure to asbestos caused an estimated 209,481 deaths, which stands for more than 70 percent of all deaths from work related cancers” is particularly startling. But what is the truth behind these numbers?

Firstly, one should keep in mind that this figure, as well as the fearmongering “disability-adjusted life years losts” quoted in the UNEP document are not factual recorded data but estimated forecast data, based on mathematical models and extrapolations.

As detailed in the ICA’s analysis (see Addendum), a review of the references cited by the UNEP document’s authors provides no clear explanation of how this impressive number was determined. The WHO itself uses a slightly different one, that stems from the 2016 Global Burden of Disease (GBD) study.

Furthermore, the UNEP document is erroneously based on the assumption that current asbestos use, strictly limited to chrysotile fibers, is similar to the situation that prevailed in the middle of the XXth century, when extensive amounts of amphibole asbestos (amosite and crocidolite) were also used. Until the 1970s, little or no distinction was made between the use of amphibole asbestos and that of chrysotile. How can the UNEP authors ignore the fundamental fact that amphibole asbestos were banned in most of the Western world in the 1980s, and that similar actions were undertaken worldwide in the following decade?



For more than 30 years, a majority of scientists have refined their analysis of the different fibers' effects: to cite one recent example, Santos et al. (2022)⁴ systematically reviewed the literature on asbestos exposure and malignant pleural mesothelioma and reported that the mean age of patients was approximately 66 years, with a mean latency period between the first exposure and diagnosis of approximately 42 years. In other words, the mesothelioma deaths occurring in 2016 were a result of exposures that occurred in the 1970s or even earlier.

Other, more defined studies had already reached similar conclusions. Gilham et al., 2015⁵ reported that all mesothelioma in the UK could be accounted for from amosite exposure alone even though of the five million tons of UK asbestos imports since 1954, 4.45 million tons of chrysotile were imported (89%), compared to 0.45 tons of amosite (9%) and 0.1 tons of crocidolite (2%). Their results confirmed that chrysotile exposure was not a factor in explaining the UK mesothelioma incidence.

More than 20 years ago, the U.S. Environmental Protection Agency (EPA) brought together a group of scientists to assess asbestos-related risk. Its report stated that *“The expert panelists unanimously agreed that the epidemiology literature provides compelling evidence that amphibole fibers have far greater mesothelioma potency than do chrysotile fibers—a finding reported both in the review document (Berman and Crump 2001) and a recent re-analysis of 17 cohort studies (Hodgson and Darnton 2000) that reported at least a 500-fold difference in potency. Two panelists commented further that the epidemiology literature provides no scientific support for chrysotile exposures having a role in causation of mesothelioma—an observation that is generally consistent with the meta-analysis in the proposed protocol, which failed to reject the hypothesis that chrysotile fibers have zero potency for mesothelioma”*.⁶

⁴ Cátia Santos, Maria dos Anjos Dixe, Ema Sacadura-Leite, Philippe Astoul, António Sousa-Uva; Asbestos Exposure and Malignant Pleural Mesothelioma: A Systematic Review of Literature. *Port J Public Health* 28 December 2022; 40 (3): 188-202.

⁵ Gilham C, Rake C, Burde# G, et al. *Occup Environ Med* Published Online First: December 29 2015 doi:10.1136/oemed-2015-103074 See: <https://oem.bmj.com/content/73/5/290>

⁶ See: [Report on the Peer Consultation Workshop to Discuss an proposed Protocol to Assess Asbestos-Related Risk, EPA, 2003](#)

It should also be noted that the UNEP document or references cited therein provide no differential information on the potency of chrysotile alone at exposure levels that occur today. However, such information does exist: Schonfeld et al., 2017⁷, reported on the airborne dust concentrations in one the largest chrysotile asbestos operation since the 1890's and still operating today at Uralasbest in Russia from over 90,000 dust measurements collected across six factories and a mine covering five decades. In 1950, the total dust concentration ranged from 50 to 1000 mg/m³, but as early as 2000, control measures reduced the concentration to a range of 0.5 to 8 mg/m³ depending on activity. In a follow-up publication on cancer mortality at the same mine, Schüz et al. (2024)⁸ presented in the supplementary data to the study⁹ that no statistically significant difference was found for lung cancer in men based on chrysotile fibers/cm³-years, even with the earlier high exposure levels.

Simply put, international scientific data provides overwhelming evidence that today, the use of chrysotile alone, without mixed amphibole exposures and at considerably lower exposure concentrations than those that occurred when many of the epidemiology studies cited in the UNEP document were performed, does not cause mesothelioma and certainly would not be associated “with 70% of work-related cancers”.

⁷ Schonfeld SJ, Kovalevskiy EV, Feletto E, Bukhtiyarov IV, Kashanskiy SV, Moissonier M, Straif K, McCormack VA, Schüz J, Kromhout H. Temporal Trends in Airborne Dust Concentrations at a Large Chrysotile Mine and its Asbestos-enrichment Factories in the Russian Federation During 1951-2001. *Ann Work Expo Health*. 2017 Aug 1;61(7):797-808. doi: 10.1093/annweh/wxx051. PMID: 28810689; PMCID: PMC6005011.

⁸ Schüz J, Kovalevskiy E, Olsson A, Moissonier M, Ostroumova E, Ferro G, Feletto E, Schonfeld SJ, Byrnes G, Tskhomariia I, Straif K, Morozova T, Kromhout H, Bukhtiyarov I. Cancer mortality in chrysotile miners and millers, Russian Federation: main results (Asbest Chrysotile Cohort-Study). *J Natl Cancer Inst*. 2024 Jun 7;116(6):866-875. doi: 10.1093/jnci/djad262. PMID: 38247448;

⁹ Supplementary data <https://academic.oup.com/jnci/article/116/6/866/7577290#supplementary-data> Accessed October 3rd 2024

2.2 – ENVIRONMENTAL IMPACTS

On the topic of asbestos related-environmental impacts, it is in itself very telling that the leading global authority in its area of expertise can only come up, in its document, with three meager paragraphs filled with approximative, if not downright spurious data. Which conclusions could one possibly draw from generic affirmations such as “[A]sbestos can remain suspended in the air (...) thus contaminating areas far away from source”, or “[D]eterioration of ecosystems is evident in many asbestos sites, particularly closed/abandoned sites”?

Furthermore, after admitting that “[S]tudies on the impact of asbestos on wild fauna and flora is (sic) scarce”, the UNEP document, in a revealing shift, then refers to unspecified and undocumented “various tests” on animals that involved inhalation and injections of various amphibole fibers, at concentrations nonexistent in natural conditions. The fact that the subjects exhibited tumors is nevertheless enough for them to declare that such results provide insight into the carcinogenic effects of asbestos “across different animal species”.

Beyond the high school level, disputable nature of the amalgamation, it is also telling that the UNEP document ignores studies conducted with lab rats [proving the low biopersistence of chrysotile fibers in the lungs](#)¹⁰. This is coherent with the authors’ decision not to differentiate between different types of fibers, despite the amount of scientific evidence that undoubtedly point in the opposite direction.

¹⁰ See for example <https://pubmed.ncbi.nlm.nih.gov/18788018/> Consulted March 2025

2.3 – SOCIAL AND ECONOMIC EFFECTS

On the issue of the social consequences of massive past amphibole asbestos uses, the UNEP document correctly focuses on the “burden for patients and their families”, the “healthcare cost” and, last but not least, on the “costs arising from the victim’s compensation and legal actions against (asbestos) companies”. Again, this situation partly reflects the legacy of historical circumstances such as the extensive use of amphibole flocking in post WW2 reconstruction efforts.

The UNEP document however chooses not to point out that such very sad and unfortunate situations which occurred more than half a century ago have nothing to do with the current usage of chrysotile under well-established programs of controlled and responsible use. It fails to mention that today, 95% of chrysotile asbestos used around the world is encapsulated in cement matrix used in the production of slate, flat sheets and pipes: even in the event of destruction, the chrysotile fibers simply couldn’t be released into the environment in any significant concentration that could pose serious risk to public health.

Had proper consultations been conducted in the process of producing the UNEP document, its authors would also have been made aware of the damage done by the massive US asbestos litigation money-machine industry in which law firms and part of the judicial system use potential asbestos victims to raid insurance companies of long dead businesses, to the costs of hundreds of million dollars¹¹. For that reason, uncontextualized data on health costs associated with amphibole asbestos such as the one presented in the UNEP document, especially with regards to the United States, do not constitute a realistic basis for assessing the extent of real costs, be it for individuals, the states’ social-security nets or private companies.

On the economic front, the UNEP document devotes almost four pages to spread the false idea of asbestos (without distinction between fibers) flooding the world markets and threatening the population.

¹¹ It is of interest to note that some actors of this US-based practice are currently attempting to broaden its reach both in European and other countries. Their brazenness is such that a reputable online trade publication, Legal Newsline, dedicates a [whole section of its website](#) to their excesses.

In this regard the use of the Zou et al. 2023 study and the figure 3 in page 8 are of particular significance. As indicated in the UNEP document, using the United Nations Comtrade database for the period 2004-2019, this study focusses on “46 chemicals or groups listed under the Rotterdam Convention to look into the continuing large-scale global trade and illegal trade of highly hazardous chemicals.” Without any further explanation, the authors then declare that this data enabled them to produce the estimated top trade flows of both mineral asbestos and unspecified ‘Fabricated asbestos fibres’ for the year 2022, which was translated in the remarkably confusing coloured chart in Figure 3. This time, they use the opportunistic criteria of a customs classification (HS code 2524.90 covers ‘asbestos other than crocidolite’ but includes in the same category amphibole -except crocidolite- and chrysotile asbestos) to create the false assumption of high-volume asbestos trade under a unique ‘*Mineral Asbestos*’ with a passing reference on the “chrysotile being dominant”.

CRUDE APPROXIMATIONS

Images are worth a thousand words. The authors of the UNEP document have chosen to buttress their points with equally flawed and in some case downright fallacious figures and illustrations:

- None of the figures in the document differentiate between the different types of asbestos – amphiboles (amosite and crocidolite) and chrysotile.
- In Figures 1 and 2, under generic titles, the reader is confronted with an amalgamation of generic potential situations, ill-documented hypothetical impacts and in some case extreme contextual risks, which can only result in an overall feeling of impending doom bearing no relation whatsoever with any actual state of affairs.
- As explained above and in a similar fashion, undated trade flow data in Figure 3 is used to support generically presented actual flows.
- Last but not least, the authors chose to include an illustration (Figure 5) directly borrowed from the International Ban Asbestos Secretariat – raising further doubts about the consultation processes that lead to the production of the UNEP document.

2.4 - LIFE CYCLE

Legacy issues stemming from the extraction processes and flocking of amphibole asbestos fibers in the reconstruction boom that followed WW2 are well known: low density loose amphibole asbestos-containing materials were mostly used for insulation and fire protection purposes in residential and commercial buildings as well as in public facilities construction in Western Europe, North America and Japan.

The human health and environmental problems associated with those past practices are and must be measured, circumscribed and addressed. Collectively, we now have decades of experience in those matters that allow public officials and private organizations alike to do so, in the best interest of the populations they serve. Best practices must be shared and disseminated.

But on this topic as on the other issues addressed in this UNEP document, its authors, by ignoring the basic, fundamental fact that amphibole fibers extraction and use have long been banned and abandoned, once again create a biased picture which can only hinder efforts to not only correct mistakes from the past but also facilitate initiatives that today contribute to a better future for millions of fellow citizens.

Chrysotile fiber extraction processes are governed by strict safety and security standards that have become the norm around the world. As the authors themselves admit, albeit indirectly, encapsulated chrysotile asbestos is the only legally used fiber, mostly in the form of roof tiles, flat sheets and pipes, in which the asbestos content is about 10 per cent in cement-bound state. Even in the unlikely event of their destruction, such encapsulated fibers could not be released in the environment in any harmful concentration that could pose serious risks to human health. In addition, new, promising technologies are allowing for a safe and responsible use of serpentine tailings to produce much needed material such as magnesium ingots, offering communities new development opportunities while contributing to restoring the environment.

Empty sentences such as “[D]eteriorating asbestos-containing building materials and continuing use of asbestos in some countries will only add to this burden (...)” found in p. 9 of the UNEP document senselessly amalgamate past and present: they serve only to conceal a complex but promising reality. They have no purpose other than to promote the ban of chrysotile fibers.



2.5 – REGULATIONS

The UNEP document provides an overview of various initiatives undertaken in Western countries to address legacy issues stemming from the past use of mostly amphibole asbestos. It is regrettable that these otherwise potentially useful examples suffer from a biased presentation highlighting and sometimes amplifying realities in order to serve the authors' overall purpose. Unsurprisingly, the real issues surrounding the Parties' refusal for the past 18 years to include chrysotile in the Rotterdam Convention's Annex III are obfuscated.

Data is also presented in ways that give an inflated image of issues: in the description of actions undertaken in Poland, for example, measurements of asbestos fiber concentrations in the air are presented in terms of the number of fibers per cubic meter, although the generally accepted standard for measuring fibers is counting fibers per cubic centimeter, 0.1 fiber per cubic centimeter of air being the standard threshold limit value.

Concentrations expressed according to scientific standards in fact reveal that extremely low concentrations of up to 0.0004 fibers/cm³ were registered in approximately 38 percent of measurement points, very low concentrations (from 0.0004 to 0.001 fibers/m³) were observed in 44 percent of them and that concentrations

exceeding 0.001 fibers/cm³, still far below standards, were found in the remaining 18 percent. What those measurements tell us is that even in places having "high" concentrations, those are in fact very low and correspond to the content of asbestos fibers in the natural environment.

Once again, the risks associated with past use of amphibole fibers must be taken seriously. But in view of the innumerable, dire and often life-threatening environmental issues faced by our collectivities, shouldn't we take a step back and examine our priorities?



SECTION 3
SAFER
ALTERNATIVES



The UNEP document is refreshingly honest in its acknowledgement of the need for rigorous scientific analysis of so-called safe alternatives to asbestos. Its warnings are worth underscoring:

"As in any case of chemical substitution, supplementary research (including life-cycle assessments (LCA)) and monitoring of the asbestos alternatives is warranted to avoid any unintended health and environmental consequences and regrettable substitutions. To make well-informed decisions on asbestos replacement, it is essential to conduct a LCA of potential alternatives. (...) However, only some of the substitute materials have been assessed for health hazards, and health hazard data has not been sufficient in many cases. The examination of alternatives in a study conducted by Park (2018) concluded that initiatives should be undertaken to reduce workers' exposure to replacement materials devoid of asbestos.

According to patent data from the United States and Europe, fibrous materials may be considered as an alternative to asbestos. There are many kinds of fibrous materials, which can be classified into synthetic and natural fibres. However, recent studies brought to light evidence on health hazards, including links to cancers, of fibrous materials used as asbestos substitutes."

One can only regret that the scope of this recognition is again truncated by the authors' decision to never differentiate between amphiboles and chrysotile fibers.



SECTION 4
**CONCLUDING
THOUGHTS**





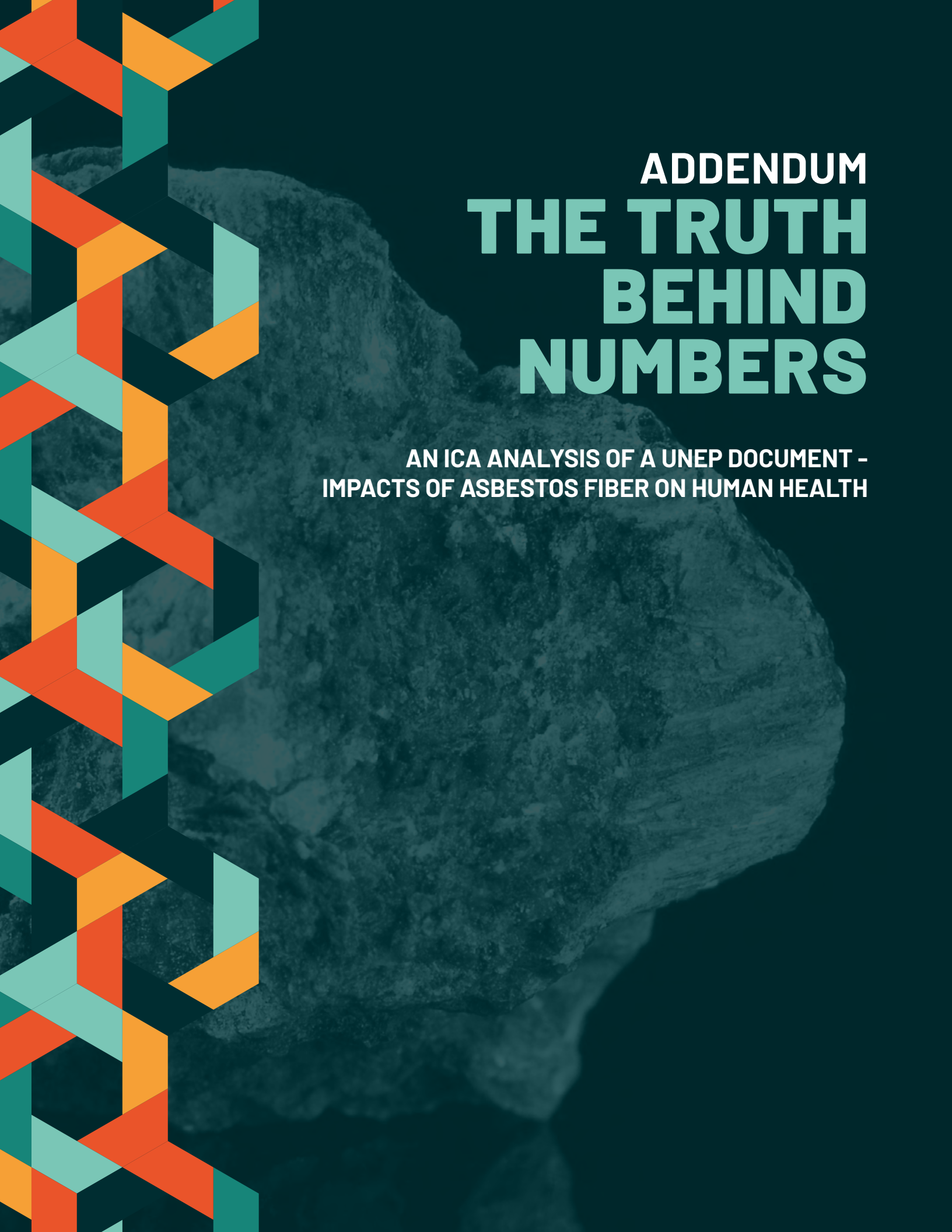
The UNEP document represents the first attempt by a UN body to examine issues related to asbestos fibers impacts from an environmental perspective, albeit mostly through the prism of its effects on human health. Unfortunately, the result should not be considered acceptable by the very UN standards its authors should have respected.

It is not the ICA's role to weight the extent to which the document's ideological preconceptions stem from the collaboration its authors received from the WHO and, to a lesser extent, from the ILO. But the UNEP's decision to ignore, in its own paper, the World Health Assembly's 2007 resolution calling for a differentiated approach of the various asbestos forms, along with decades of scientific research that supported and have since buttressed their motion, introduces a fundamental bias that simultaneously distorts and discredits their work. On the issue of human health alone, the consequences are so far-reaching that the ICA attaches a more detailed analysis of the UNEP document's shortcomings. It will be for the reader to judge.

Legacy impacts of the use of amphibole fibers are real. They take numerous forms and must be addressed. To do so effectively, we need dispassionate analyses of the most recent scientific findings, collaborative, non-ideological approaches, thorough research and identification of best practices and their tireless dissemination. We must also bear in mind that resources needed to reach our objectives will be competing with other, emerging and perhaps far more considerable risks. What should we make of the recent and still very sketchy recognition of the extensive dangers to human health and the environment associated with the pervasive use of perfluoroalkyl and polyfluoroalkyl substances (PFAS), the so-called forever chemicals that, according to [recent studies](#)¹², have now found their way in the blood of 98 per cent of Americans?

Angling as the UNEP document does for the complete ban of chrysotile fibers under the guise of various options is at best naïve, and most likely hypocritical. Chrysotile fibers are an asset that we cannot afford to ignore, especially where the critical health and sanitary needs of citizens from emerging or fragile economies warrant the use efficient, durable and safe material devoid of long-term risks.

¹² See: https://www.atsdr.cdc.gov/2019-annual-report/php/pfas.html?CDC_AAref_Val=https://www.atsdr.cdc.gov/2019atsdrannualreport/stories/pfas.html Consulted March 7th 2025.



ADDENDUM
THE TRUTH
BEHIND
NUMBERS

**AN ICA ANALYSIS OF A UNEP DOCUMENT -
IMPACTS OF ASBESTOS FIBER ON HUMAN HEALTH**

HIGHLIGHTS

- A document published by the UNEP in February 2024¹, with the collaboration of the WHO and the ILO, estimated that in 2016 asbestos caused 209,481 deaths, which stands for more than 70 per cent of all deaths from work related cancers.
- The document's estimate was based on mixed exposures which occurred in the last century when amphiboles were often used - not today when only chrysotile is used.
- This estimate does not provide any indication of the risk associated with the current exclusive use of chrysotile.
- While the UNEP document takes potency differences between chrysotile and amphibole asbestos into account, especially for mesothelioma, the final risk assessment uses combined estimates across all asbestos types due, as was claimed, to the mixed nature of reported exposures over several decades. Separate risk estimates for chrysotile vs amphiboles fibers were not presented in the final exposure-risk relationship table.
- There is strong evidence today that chrysotile does not cause mesothelioma.
 - Data presented in a recent epidemiology study of the largest and oldest chrysotile mine has shown that chrysotile does not cause lung cancer.
 - As presented (in the supplementary data) in this epidemiology study on workers from this chrysotile mine in Russia, no statistically significant association with lung cancer in men based on chrysotile fibers/cm³-years was observed even with earlier high exposure levels.
- The UNEP calls for studies on alternative to chrysotile which we fully support. These studies should be conducted on an equivalent fiber exposure basis.

CONTEXT

Early in 2024, a paper titled "[Options for addressing asbestos contaminants in products and the environment](#)" was distributed as an information document to the participants to the 6th session of the United Nations Environment Programme (UNEP)'s UN Environment Assembly¹³, which was held in Nairobi, Kenya, between February 26th and March 1st 2024. In it, the authors stated that in 2016, asbestos caused an estimated 209,481 deaths, which stand for more than 70 percent of all deaths from work-related cancers.

The ICA's analysis of the information concerning asbestos in the UNEP document does not provide any indication on the risk of using chrysotile only today. For chrysotile, the UNEP's estimate has no validity based on current scientific publications and data. In fact, the current use of chrysotile alone has little, if any, contribution to workplace mortality today.

On the other hand, the UNEP document does address the important issue of assessing alternatives to chrysotile fibers, as ICA has long been advocating. Those issues are summarized below.

¹³ UNEP in cooperation with the World Health Organization (WHO) and with input from the International Labor Organization (ILO) prepared the paper following a request from the participants to the 5th Session of the UN Environment Assembly of the UNEP.

KEY ISSUES

In the opening page of the UNEP document, the authors state that "Globally, in 2016, occupational exposure to asbestos caused an estimated 209,481 deaths, which stands for more than 70 percent of all deaths from work-related cancers." A review of the references cited by its authors¹⁴ provides no clear explanation of how this impressive number was determined other than that it represents a cumulative sum of mesothelioma, trachea, bronchus, lung, ovary, and larynx cancers.

This number raises questions. The WHO itself uses a slightly different number: the WHO Global Health Estimates, stemming from the 2016 Global Burden of Disease (GBD) study¹⁵, state that there were 218,827 asbestos attributed cancer deaths. It must be noted that in the same way, the ICA's review revealed that the number

of deaths from mesothelioma worldwide in 2016, which has been historically associated with amphibole asbestos exposure, was reported by WHO to be 23,104, while in the GBD study estimates this number was 27,612.

It also seems that the UNEP document presupposes that current asbestos use, strictly limited to chrysotile fibers, is similar to the situation that prevailed in the middle of the XXth century when extensive amounts of amphibole asbestos (amosite and crocidolite) were also used.

¹⁴ Mandrioli et al. 2018 WHO/ILO work-related burden of disease and injury: Protocol for systematic reviews of occupational exposure to dusts and/or fibres and of the effect of occupational exposure to dusts and/or fibres on pneumoconiosis. *Environ Int.* 2018 Oct;119:174-185. doi: 10.1016

- European Commission 2022. Commission staff working document impact assessment. Proposal for a Directive of the European Parliament and of the Council amending Directive 2009/148/EC on the protection of workers from the risks related to exposure to asbestos at work. https://eur-lex.europa.eu/legalcontent/EN/TXT/PDF/?uri=CONSIL:ST_12863_2022_ADD_2&qid=1673446822849&from=EN. Accessed October 2023

- Schlünssen, et al. 2023. The prevalences and levels of occupational exposure to dusts and/or fibres (silica, asbestos and coal): A systematic review and meta-analysis from the WHO/ILO Joint Estimates of the Work-related Burden of Disease and Injury. *Environment International* 107980.

¹⁵ See table 1 of GBD 2016 Occupational Carcinogens Collaborators. Global and regional burden of cancer in 2016 arising from occupational exposure to selected carcinogens: a systematic analysis for the Global Burden of Disease Study 2016. *Occup Environ Med.* 2020 Mar;77(3):151-159. doi: 10.1136/oemed-2019-106012. PMID: 32054819; PMCID: PMC7035689.

The use of amphibole asbestos in the last century may still result in mesotheliomas today, but those diseases are not a result of the current use of chrysotile. To cite but one example, Santos et al. (2022)¹⁶ systematically reviewed the literature on asbestos exposure and malignant pleural mesothelioma and reported that the mean age of patients was approximately 66 years, with a mean latency period between the first exposure and diagnosis of approximately 42 years. Thus, the mesothelioma deaths occurring in 2016 were a result of exposures that occurred in the 1970s or even earlier and are not the result from any possible current exposures to chrysotile.

Until the 1970s, little or no distinction was made between the use of amphibole asbestos and that of chrysotile. Amphibole asbestos, need it be repeated, were banned in most of the Western world in the 1980s, and similar actions were undertaken worldwide in the following decade.

The UNEP document states that of the 209,481 deaths, 177,614 were from lung cancers, which its authors attributed to asbestos exposure. This derivation appears to be based on a ratio of mesothelioma to lung cancers in cohorts heavily exposed decades ago to both amphibole and chrysotile asbestos¹⁷. A search of the GBD Study database for risk factors associated with asbestos exposure shows three citations as the basis for their determination (Lentes et al., 2011; Goodman et al., 1999; Camargo et al., 2011). The oldest exposures cited in these publications range from 1904 to 1939, a period when exposures were exceedingly high and when there was little, if any, differentiation between amphibole and chrysotile asbestos.

As only chrysotile is used today, extrapolating asbestos-related deaths from mixed exposures at high exposure concentrations is meaningless. Gilham et al., 2015¹⁸ reported that all mesothelioma in the UK could be accounted for from amosite exposure alone even though of

¹⁶ Cátia Santos, Maria dos Anjos Dixe, Ema Sacadura-Leite, Philippe Astoul, António Sousa-Uva; Asbestos Exposure and Malignant Pleural Mesothelioma: A Systematic Review of Literature. *Port J Public Health* 28 December 2022; 40 (3): 188-202.

¹⁷ UNEP used an asbestos impact ratio (AIR) approach where the AIR was defined as the excess deaths due to mesothelioma observed in a population divided by the excess deaths in a hypothetical population heavily exposed to asbestos (without differentiating chrysotile from amphibole asbestos).

¹⁸ Gilham C, Rake C, Burdett G, et al. *Occup Environ Med* Published Online First: December 29, 2015. doi:10.1136/oemed-2015-103074 See: <https://oem.bmj.com/content/73/5/290>

the five million tons of UK asbestos imports since 1954, 4.45 million tons of chrysotile were imported (89%), compared to 0.45 tons of amosite (9%) and 0.1 tons of crocidolite (2%). Their results confirm that chrysotile exposure was not a factor in explaining the UK mesothelioma incidence.

Another publication (McCormack et al., 2012)¹⁹ estimated the asbestos-related lung cancer burden from mesothelioma mortality: it included 68 risk estimates drawn from 55 studies, in which excess cancer deaths were calculated for each cohort based on observed minus expected deaths, based on national/ regional age- and sex-specific rates, to obtain Standardized Mortality Ratios (SMR)²⁰.

Again, the studies included high exposures that occurred many years ago. The authors estimated fiber-specific ratios which characterize the overall asbestos-related lung cancer to mesothelioma relationship across different exposure circumstances

and over a long period of time. In these studies, there was a marked correlation between lung cancer SMR and mesothelioma cohorts exposed to the amosite asbestos (amphibole). For amphibole asbestos, estimates suggest there was between a 6% and 10% increase in lung cancer deaths for every mesothelioma death in 1,000 deaths. Chrysotile cohorts had a wider range of estimates, resulting from little correlation between excess lung cancers and mesotheliomas. When present, the authors state that it appears that many of the mesotheliomas were actually due to amphibole exposure. The authors state that “for chrysotile, widely consumed today, asbestos-related lung cancers cannot be robustly estimated from few mesothelioma deaths and the latter cannot be used to infer no excess risk of lung or other cancers”. Their analysis does not exclude a lung cancer effect from these older cohorts but mentions that smoking can be a major contributor.

¹⁹ McCormack V, Peto J, Byrnes G, Straif K, Boffetta P. Estimating the asbestos-related lung cancer burden from mesothelioma mortality. *Br J Cancer*. 2012 Jan 31;106(3):575-84. doi: 10.1038/bjc.2011.563. Epub 2012 Jan 10. Erratum in: *Br J Cancer*. 2014 Dec 9;111(12):2381. PMID: 22233924; PMCID: PMC3273352.

²⁰ The Standardized Mortality Ratio (SMR) is a statistical measure to compare the mortality rate of a study group to that of a standard population.



The UNEP document or the references cited therein provide no differential information on the potency of chrysotile alone at exposure levels that occur today.

But such information does exist: Schonfeld et al., 2017²¹, reported on the airborne dust concentrations in one of the largest chrysotile asbestos operations since the 1890's and still operating today at Uralasbest in Russia from over 90,000 dust measurements collected across six factories and a mine covering five decades. In 1950, the total dust concentration ranged from 50 to 1,000 mg/m³, but as early as 2000, control measures reduced the concentration to a range of 0.5 to 8 mg/m³ depending on activity. In a follow-up publication on cancer mortality at the same mine, Schüz et al. (2024)²² presented in the supplementary data to the study that no statistically significant difference was found for lung cancer in men based on chrysotile fibers/cm³-years even with the earlier high exposure

levels. The [study's abstract](#)²³ and pages 4-6 of the [supplementary data](#)²⁴ (Table 4) from the Schüz et al., (2024) publications are included in Annex 1 and 2 of the present document.

Currently, as only chrysotile is used in controlled environments, no cancer mortality would be expected.

There is clear evidence provided in the scientific literature that today, the use of chrysotile alone without mixed amphibole exposures and with considerably lower exposure concentrations (than which occurred when many of the epidemiology studies cited were performed) does not cause mesothelioma and certainly would not be associated “with 70% of work-related cancers”.

²¹ Schonfeld SJ, Kovalevskiy EV, Feletto E, Bukhtiyarov IV, Kashanskiy SV, Moissonier M, Straif K, McCormack VA, Schüz J, Kromhout H. Temporal Trends in Airborne Dust Concentrations at a Large Chrysotile Mine and its Asbestos-enrichment Factories in the Russian Federation During 1951-2001. *Ann Work Expo Health*. 2017 Aug 1;61(7):797-808. doi: 10.1093/annweh/wxx051. PMID: 28810689; PMCID: PMC6005011.

²² Schüz J, Kovalevskiy E, Olsson A, Moissonier M, Ostroumova E, Ferro G, Feletto E, Schonfeld SJ, Byrnes G, Tskhomariia I, Straif K, Morozova T, Kromhout H, Bukhtiyarov I. Cancer mortality in chrysotile miners and millers, Russian Federation: main results (Asbest Chrysotile Cohort-Study). *J Natl Cancer Inst*. 2024 Jun 7;116(6):866-875. doi: 10.1093/jnci/djad262. PMID: 38247448;

²³ See: <https://academic.oup.com/jnci/article/116/6/866/7577290> Accessed March 2025

²⁴ Supplementary data <https://academic.oup.com/jnci/article/116/6/866/7577290#supplementary-data> Accessed October 3rd 2024.

ABOUT ALTERNATIVES

The need for rigorous database referencing and differentiation between fiber types is especially important in light of increasingly vocal calls for using alternatives to the chrysotile fiber. The UNEP document is remarkably honest in its remarks on the lack of scientific data on health hazards related to so-called "safer alternatives"²⁵:

"As in any case of chemical substitution, supplementary research (including life-cycle assessments (LCA)) and monitoring of the asbestos alternatives is warranted to avoid any unintended health and environmental consequences and regrettable substitutions. To make well-informed decisions on asbestos replacement, it is essential to conduct a LCA of potential alternatives. (...) However, only some of the substitute materials have been assessed for health hazards, and health hazard data has not been sufficient in many cases. The examination of alternatives in a study conducted by Park (2018) concluded that initiatives should be undertaken to reduce workers' exposure to replacement materials devoid of asbestos.

According to patent data from the United States and Europe, fibrous materials may be considered as an alternative to asbestos. There are many kinds of fibrous materials, which can be classified into synthetic and natural fibres. However, recent studies brought to light evidence on health hazards, including links to cancers, of fibrous materials used as asbestos substitutes."

The ICA welcomes this recognition by UNEP of the need for more research on alternatives to chrysotile and hopes that its call will be heard within the WHO, the ILO as well as by all parties to the Rotterdam Convention. The ICA encourages authorities to evaluate the potential toxicity of all fibers, including alternatives, based on equal fiber number exposure.

²⁵ See <https://documents.un.org/doc/undoc/gen/k24/003/25/pdf/k2400325.pdf> pp. 14-15. Accessed October 3rd 2024.

ANNEX 1





Cancer mortality in chrysotile miners and millers, Russian Federation: main results (Asbest Chrysotile Cohort-Study)

Joachim Schüz , PhD,^{1,*†} Evgeny Kovalevskiy, PhD, MD,^{2,3,†} Ann Olsson , PhD,¹ Monika Moissonnier, MSc,¹ Evgenia Ostroumova, PhD, MD,¹ Gilles Ferro, MSc,¹ Eleonora Feletto , PhD,^{1,4} Sara J. Schonfeld, PhD,^{1,5} Graham Byrnes, PhD,¹ Iraklii Tskhomariia,² Kurt Straif , PhD, MPH, MD,¹ Tatiana Morozova, PhD,³ Hans Kromhout , PhD,⁶ Igor Bukhtiyarov, PhD, MD^{2,3}

¹International Agency for Research on Cancer-World Health Organization, Lyon, France

²Federal State Budgetary Scientific Institution, Izmerov Research Institute of Occupational Health, Moscow, Russian Federation

³I.M. Sechenov First Moscow State Medical University (Sechenov University), Moscow, Russian Federation

⁴The Daffodil Centre, The University of Sydney, A Joint Venture with Cancer Council New South Wales, Sydney, Australia

⁵Division of Cancer Epidemiology and Genetics, National Cancer Institute, National Institutes of Health, Bethesda, MD, USA

⁶Institute for Risk Assessment Sciences, Utrecht University, Utrecht, the Netherlands

*Correspondence to: Joachim Schüz, PhD, Environment and Lifestyle Epidemiology Branch, International Agency for Research on Cancer/World Health Organization, 25 Avenue Tony Garnier, 69366 Lyon CEDEX 07, France (e-mail: schuzj@iarc.who.int).

†These authors contributed equally to this work.

Abstract

Background: We investigated mortality in workers of the world's largest chrysotile mine and enrichment factories located in the town of Asbest, Russian Federation.

Methods: This historical cohort study included all workers employed for at least 1 year between 1975 and 2010 and follow-up until the end of 2015. Cumulative exposure to dust was estimated based on workers' complete occupational history linked to dust measurements systematically collected from the 1950s. Exposure to chrysotile fibers was estimated using dust-to-fiber conversion factors. Relative risks (RRs) and 95% confidence intervals (CIs) were estimated as mortality rate ratios in Poisson regression models.

Results: A total of 30 445 (32% women) workers accumulated 721 312 person-years at risk and 11 110 (36%) died. Of the workers, 54% had more than 30 years since their first exposure. We found an exposure-response between cumulative dust and lung cancer mortality in men. No clear association with dust exposure but a modest increase in the highest category of fiber exposure was seen for lung cancer in women. Mesothelioma mortality was increased (RR = 7.64, 95% CI = 1.18 to 49.5, to at least 80 fibers per cm³ years and RR = 4.56, 95% CI = 0.94 to 22.1, to at least 150 mg/m³ years [dust]), based on 13 deaths. For colorectal and stomach cancer, there were inconsistent associations. No associations were seen for laryngeal or ovarian cancer.

Conclusion: In this large-scale epidemiological study in the world's largest active asbestos mine, we confirmed an increased risk of mesothelioma with high fiber exposure and an increasing mortality for lung cancer in men with increasing dust exposure. Less clear-cut increased lung cancer mortality was seen in the women. Continued mortality follow-up is warranted.

ANNEX 2



SUPPLEMENTARY DATA

Supplementary material to: Schüz, et al., Cancer mortality in chrysotile miners and millers, Russian Federation: main results (Asbest Chrysotile Cohort-Study). J Natl Cancer Inst. 2024 Jun 7;116(6):866-875. doi: 10.1093/jnci/djad262. PMID: 38247448;

<https://academic.oup.com/jnci/article/116/6/866/7577290#supplementary-data> Accessed October 3rd, 2024.

Supplementary Table 4. Mortality rate ratios (RR) and 95% confidence intervals (CI) for categories of cumulative dust exposure and cumulative fibre exposure, by deaths from different causes and cancer sites, by applying lag times of 10 years and of 20 years, by sex, adjusted for age and time since last employment.

NOTE: Mortality rate ratios (RR) are considered statistically significant only when the 95% confidence interval (CI) does not include 1.0. Specifically, for a mortality rate ratio to be statistically significant, the lower limit of the 95% CI must be greater than 1.0. For Lung Cancer Fibers/cm³-years all values are not statistically significant.

Supplementary Table 4. Mortality rate ratios (RR) and 95% confidence intervals (CI) for categories of cumulative dust exposure and cumulative fibre exposure, by deaths from different causes and cancer sites^a, by applying lag times of 10 years and of 20 years, by sex, adjusted for age and time since last employment

Dust category (mg/m ³ -years)	Men				Women			
	10-year lag		20-year lag		10-year lag		20-year lag	
	<i>N</i> deaths	RR (CI)	<i>N</i> deaths	RR (CI)	<i>N</i> deaths	RR (CI)	<i>N</i> deaths	RR (CI)
	All deaths				All deaths			
0 ^b	536	1.10 (0.99–1.23)	1595	0.94 (0.87–1.01)	76	0.79 (0.59–1.05)	303	0.96 (0.82–1.14)
>0–20	2208	1.00	2097	1.00	506	1.00	512	1.00
≥20–65	2261	0.94 (0.89–1.00)	2096	0.92 (0.86–0.98)	823	1.03 (0.92–1.15)	768	0.99 (0.89–1.11)
≥65–150	2079	0.90 (0.84–0.96)	1513	0.93 (0.86–1.00)	821	0.94 (0.84–1.05)	708	0.93 (0.83–1.05)
≥150	1186	0.98 (0.90–1.06)	969	1.00 (0.92–1.09)	614	1.01 (0.89–1.14)	549	1.01 (0.89–1.14)
<i>p</i> for trend	0.11		0.83		0.77		0.96	
	All cancers (main ICD group C)				All cancers (main ICD group C)			
0	44	1.20 (0.87–1.67)	161	1.04 (0.86–1.27)	15	0.90 (0.50–1.61)	67	1.03 (0.73–1.45)
>0–20	285	1.00	323	1.00	97	1.00	99	1.00
≥20–65	435	1.06 (0.91–1.24)	468	1.06 (0.91–1.22)	169	1.09 (0.85–1.41)	145	1.04 (0.81–1.35)
≥65–150	494	1.10 (0.94–1.29)	362	1.13 (0.96–1.34)	137	0.88 (0.67–1.15)	121	1.03 (0.78–1.36)
≥150	268	1.14 (0.95–1.37)	212	1.12 (0.93–1.36)	117	1.13 (0.85–1.50)	103	1.24 (0.93–1.66)
<i>p</i> for trend	0.17		0.20		0.79		0.26	
	Lung cancer				Lung cancer			
0	13	1.14 (0.63–2.05)	54	1.03 (0.74–1.44)	1	1.49 (0.17–13.08)	6	4.02 (1.09–14.90)
>0–20	95	1.00	116	1.00	7	1.00	4	1.00
≥20–65	161	1.19 (0.92–1.55)	177	1.12 (0.88–1.43)	10	0.74 (0.28–1.95)	9	1.25 (0.38–4.06)
≥65–150	190	1.34 (1.02–1.76)	135	1.27 (0.97–1.67)	11	0.65 (0.25–1.70)	10	1.33 (0.41–4.31)
≥150	105	1.44 (1.06–1.95)	82	1.31 (0.97–1.79)	12	1.07 (0.42–2.75)	12	2.34 (0.75–7.38)
<i>p</i> for trend	0.01		0.06		0.78		0.07	
	Laryngeal cancer ^c				Ovarian cancer			

	Stomach cancer				Stomach cancer			
0	6	1.12 (0.45–2.80)	22	1.02 (0.57–1.81)	5	2.01 (0.66–6.13)	11	0.90 (0.39–2.08)
>0–20	30	1.00	34	1.00	15	1.00	18	1.00
≥20–65	54	1.33 (0.84–2.12)	57	1.33 (0.85–2.06)	24	1.00 (0.52–1.92)	18	0.74 (0.38–1.44)
≥65–150	64	1.55 (0.96–2.51)	49	1.69 (1.04–2.74)	13	0.55 (0.26–1.20)	11	0.56 (0.26–1.23)
≥150	33	1.54 (0.90–2.66)	25	1.45 (0.83–2.54)	14	0.91 (0.42–1.94)	13	0.94 (0.44–2.00)
<i>p for trend</i>		0.06		0.08		0.38		0.47
	Colorectal cancer				Colorectal cancer			
0	3	1.59 (0.46–5.54)	12	1.54 (0.74–3.21)	1	0.44 (0.05–3.81)	6	0.72 (0.24–2.13)
>0–20	18	1.00	20	1.00	14	1.00	13	1.00
≥20–65	41	1.36 (0.78–2.40)	41	1.23 (0.71–2.13)	22	0.94 (0.48–1.84)	19	0.96 (0.47–1.95)
≥65–150	43	1.09 (0.61–1.95)	35	1.23 (0.68–2.21)	22	0.83 (0.42–1.65)	24	1.27 (0.63–2.56)
≥150	29	1.35 (0.72–2.51)	26	1.53 (0.82–2.85)	18	0.99 (0.48–2.04)	15	1.12 (0.52–2.41)
<i>p for trend</i>		0.65		0.18		0.90		0.66
Fibre category (f/cm ³ -years)	Men				Women			
	10-year lag		20-year lag		10-year lag		20-year lag	
	<i>N</i> deaths	RR (CI)	<i>N</i> deaths	RR (CI)	<i>N</i> deaths	RR (CI)	<i>N</i> deaths	RR (CI)
	All deaths				All deaths			
0 ^b	536	1.10 (0.98–1.22)	1595	0.93 (0.86–1.00)	76	0.79 (0.59–1.06)	303	0.95 (0.81–1.12)
>0–12	2256	1.00	2248	1.00	524	1.00	545	1.00
≥12–40	2621	0.94 (0.89–1.00)	2524	0.90 (0.85–0.96)	916	1.03 (0.92–1.15)	870	0.98 (0.88–1.09)
≥40–80	2064	0.86 (0.80–0.92)	1341	0.88 (0.81–0.95)	758	0.92 (0.82–1.03)	622	0.90 (0.80–1.01)
≥80	793	0.97 (0.89–1.06)	562	1.02 (0.92–1.12)	566	0.95 (0.84–1.07)	500	0.98 (0.87–1.11)
<i>p for trend</i>		0.01		0.16		0.17		0.63
	All cancers (main ICD group C)				All cancers (main ICD group C)			
0	44	1.14 (0.82–1.57)	161	0.97 (0.80–1.17)	15	0.91 (0.51–1.64)	67	1.01 (0.72–1.43)
>0–12	309	1.00	374	1.00	95	1.00	103	1.00
≥12–40	495	0.98 (0.85–1.14)	557	0.95 (0.83–1.09)	179	1.10 (0.86–1.42)	163	1.04 (0.81–1.33)
≥40–80	489	1.00 (0.86–1.17)	295	0.92 (0.78–1.09)	134	0.95 (0.72–1.24)	111	1.02 (0.78–1.35)
≥80	189	1.13 (0.93–1.36)	139	1.18 (0.96–1.46)	112	1.12 (0.84–1.48)	91	1.17 (0.87–1.57)
<i>p for trend</i>		0.34		0.57		0.75		0.51
	Lung cancer				Lung cancer			
0	13	1.03 (0.57–1.85)	54	0.94 (0.68–1.31)	1	1.86 (0.21–16.64)	6	5.76 (1.38–24.01)
>0–12	106	1.00	135	1.00	6	1.00	3	1.00
≥12–40	183	1.07 (0.83–1.36)	214	1.01 (0.81–1.27)	12	1.02 (0.38–2.71)	12	2.14 (0.60–7.61)
≥40–80	187	1.17 (0.90–1.52)	109	1.03 (0.78–1.37)	9	0.74 (0.26–2.10)	9	2.00 (0.54–7.47)
≥80	75	1.36 (0.99–1.86)	52	1.32 (0.94–1.86)	13	1.49 (0.56–3.97)	11	3.36 (0.92–12.22)
<i>p for trend</i>		0.04		0.24		0.44		0.05

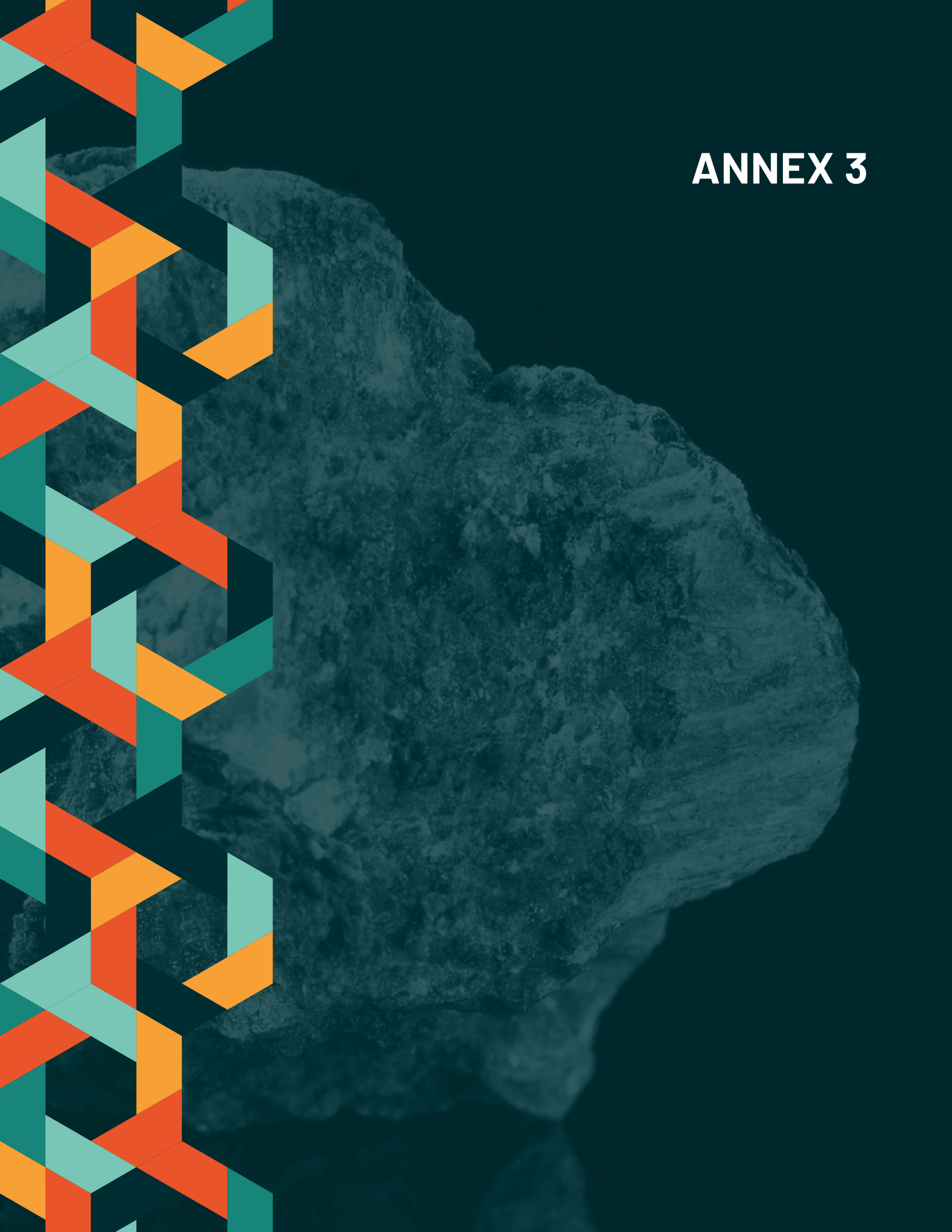
	Laryngeal cancer ^c		Ovarian cancer	
0	2 1.65 (0.35–7.73)	3 0.45 (0.13–1.55)	1 0.59 (0.07–4.96)	5 0.69 (0.23–2.12)
>0–12	12 1.00	17 1.00	10 1.00	12 1.00
≥12–40	16 0.74 (0.34–1.57)	12 0.39 (0.18–0.84)	10 0.60 (0.25–1.46)	7 0.43 (0.17–1.10)
≥40–80	9 0.41 (0.16–1.01)	10 0.71 (0.30–1.68)	9 0.72 (0.28–1.85)	10 1.09 (0.44–2.66)
≥80	7 0.89 (0.34–2.37)	4 0.73 (0.23–2.28)	5 0.60 (0.19–1.84)	1 0.16 (0.02–1.32)
<i>p for trend</i>	0.33	0.47	0.42	0.25
	Stomach cancer		Stomach cancer	
0	6 1.05 (0.43–2.59)	22 0.96 (0.55–1.69)	5 1.79 (0.59–5.38)	11 0.84 (0.37–1.92)
>0–12	33 1.00	39 1.00	17 1.00	20 1.00
≥12–40	60 1.19 (0.76–1.84)	73 1.30 (0.87–1.95)	22 0.75 (0.40–1.43)	18 0.61 (0.32–1.16)
≥40–80	70 1.55 (0.98–2.46)	40 1.40 (0.85–2.29)	15 0.60 (0.30–1.23)	14 0.72 (0.35–1.46)
≥80	18 1.18 (0.64–2.17)	13 1.25 (0.64–2.42)	12 0.68 (0.32–1.46)	8 0.57 (0.24–1.34)
<i>p for trend</i>	0.14	0.27	0.22	0.13
	Colorectal cancer		Colorectal cancer	
0	3 1.75 (0.50–6.13)	12 1.39 (0.68–2.82)	1 0.43 (0.05–3.70)	6 0.76 (0.25–2.25)
>0–12	17 1.00	24 1.00	15 1.00	13 1.00
≥12–40	46 1.46 (0.83–2.57)	51 1.11 (0.68–1.83)	24 0.90 (0.47–1.72)	23 1.08 (0.55–2.15)
≥40–80	44 1.21 (0.67–2.19)	25 0.82 (0.45–1.49)	20 0.80 (0.40–1.58)	21 1.33 (0.65–2.69)
≥80	24 1.91 (1.00–3.66)	22 1.98 (1.07–3.66)	17 0.94 (0.46–1.91)	14 1.22 (0.56–2.64)
<i>p for trend</i>	0.16	0.13	0.78	0.60

^a ICD codes for cancer sites are: lung, C33–C34; larynx, C32; ovary, C56; stomach, C16; colon and rectum, C18–C21.

^b Because the 10-year or 20-year lag time was applied, some workers had no occupational exposure to dust or fibres; as the counting of risk time started with first exposure, they are kept as a separate group and displayed only for the purpose of completeness (see Materials and Methods)

^c Only 1 case of laryngeal cancer in women; therefore, analysis for women was not carried out.

ANNEX 3





**UNITED
NATIONS**

UNEP/EA.6/INF/14



**United Nations
Environment
Programme**

Distr.: General
6 February 2024
English only

**United Nations Environment Assembly
of the United Nations Environment Programme
Sixth session**
Nairobi, 26 February–1 March 2024
Item 5 of the provisional agenda*

International environmental policy and governance issues

Information on the implementation of paragraph 24 of resolution 5/7 on the sound management of chemicals and waste, presenting a paper entitled “Options for addressing asbestos contaminants in products and the environment”

Note by the secretariat

1. In paragraph 24 of resolution 5/7 on the sound management of chemicals and waste, the United Nations Environment Assembly of the United Nations Environment Programme (UNEP) requested the Executive Director of UNEP, subject to the availability of resources and in cooperation with the World Health Organization, to present a full range of options for addressing asbestos contaminants in products and the environment for consideration by the Environment Assembly at its sixth session.
2. In response to this request, UNEP, in cooperation with the World Health Organization and with input from the International Labour Organization, prepared a paper entitled “Options for addressing asbestos contaminants in products and the environment”.
3. The paper, presented in the annex to the present note, provides an overview of the foundational knowledge on asbestos, including its adverse impacts on human health and the environment, and the material flows along the life cycle. It outlines lessons learned from regulatory approaches applied in various countries, provides considerations on alternatives, and presents a range of recommended options for addressing asbestos in the environment.

* UNEP/EA.6/1.

Annex

Information on the implementation of paragraph 24 of resolution 5/7 on the sound management of chemicals and waste, presenting a paper entitled “Options for addressing asbestos contaminants in products and the environment”

Options for addressing asbestos contaminants in products and the environment.

About the document

Following the request from the fifth session of the United Nations Environment Assembly (UNEA), a joint paper on ‘Options for addressing asbestos contaminants in products and the environment’ was prepared by United Nations Environment Programme (UNEP) in cooperation with World Health Organization (WHO)¹ and with inputs from International Labour Organization (ILO).²

The following paper provides an overview of the foundational knowledge on asbestos, including its adverse impacts on the human health and the environment, and the material flows along the life cycle. It outlines lessons learned from regulatory approaches applied in various countries, provides considerations for safe alternatives and presents a range of recommended options for addressing asbestos in the environment. The paper does not encompass an exhaustive review of all available information and references but is a summary of a rapid review.

Key findings

- Evidence persists that exposure to asbestos and asbestos containing materials (ACMs) threatens the health of humans, causing severe diseases including mesothelioma, asbestosis and cancers of the lung, larynx, and ovary.
- Millions of metric tons of asbestos are still in buildings and in products across the world, and new ACMs are being manufactured and introduced into commerce.
- The threat of asbestos to humans and to the environment is particularly dire in areas where there is a lack of coordinated asbestos management plans, reduced awareness about asbestos health risks, or delay in the implementation of asbestos-ban.
- Globally in 2016, occupational exposure to asbestos caused an estimated 209,481 deaths, which stands for more than 70 per cent of all deaths from work-related cancers.
- Asbestos contamination as an impurity has been found in consumer products, including powdered cosmetics, baby powder and crayons.

¹ Disclaimer: WHO’s technical input is being provided on the understanding that this document contains the report prepared by UNEP at the request of UNEA (“the Report”) and does not represent the views, decisions or policies of WHO. The designations employed and the presentation of the material in the Report do not imply the expression of any opinion whatsoever on the part of WHO concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted and dashed lines on maps represent approximate border lines for which there may not yet be full agreement. The mention of specific companies or of certain manufacturers’ products in the Report does not imply that they are endorsed or recommended by WHO in preference to others of a similar nature that are not mentioned. WHO’s technical input is being provided without warranty of any kind, either expressed or implied. The responsibility for the interpretation and use of the material lies with the reader. In no event shall WHO be liable for damages arising from its use.

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- There is ongoing evidence that mismanagement of asbestos is resulting in elevated healthcare expenses that surpass any benefits. Over the lifetime of all patients with an asbestos-related disease, burden of disease costs has been estimated to be US\$11 billion.
- Efforts to tackle the continuing risks of asbestos have been implemented, yielding valuable lessons. Asbestos mining and use persist because regulations on asbestos are weak or inadequate; there is low awareness on hazards of asbestos exposure and on the availability of safer alternatives; and removal of asbestos from existing structures is costly and complex.
- An examination of the economic effects of asbestos bans concluded that in countries that transitioned away from asbestos, no negative economic impact was seen following the enforcement of the bans.
- In certain instances, the lack of consensus within the government has hindered national efforts to implement effective controls and/or bans on asbestos use, highlighting the difficulty of achieving multisectoral governance.

Considering the existing evidence, the following five recommended options for management of asbestos are suggested to guide relevant stakeholders and others:

- Option 1: Reinforcing legal frameworks and institutional mechanisms to bolster the elimination asbestos-related diseases by stopping the use of all types of asbestos and managing asbestos risks across its entire life cycle.
- Option 2: Investigating and adopting safer alternatives to asbestos and incorporating innovative and sustainable solutions throughout product value chains, using a life-cycle approach.
- Option 3: Adopting evidence-based strategies to deal with asbestos already in use and to tackle the legacy uses and exposure to asbestos.
- Option 4: Cultivating partnerships and improving resource mobilization, to reinforce capacity-building and advance awareness-raising efforts about the risks of asbestos.
- Option 5: Enhancing the generation of comprehensive knowledge and data, strengthening early diagnosis, treatment, and rehabilitation services, and ensuring access to information concerning asbestos to support informed decision-making and actions.

These options align with the strategic objectives and targets outlined in the Global Framework on Chemicals - For a Planet Free of Harm from Chemicals and Waste (GFC). The GFC's unique and multi-stakeholder approach can contribute to addressing asbestos contaminants in products and the environment while driving the transformational shift towards innovation to provide safer and more sustainable products and advancement of sustainable consumption and production patterns.

The outlined options for addressing asbestos-related issues are mutually reinforcing, creating a comprehensive and interconnected strategy. Customizing these five options to align with specific regional and national conditions is essential for effectively managing and mitigating the risks associated with asbestos contamination in both products and the environment.

Option 1 serves as a foundational pillar, focusing on reinforcing legal frameworks and institutional mechanisms to eliminate asbestos-related diseases. Robust legal structures and institutional support are vital for ensuring compliance, monitoring asbestos life cycles, and enforcing the cessation of asbestos use.

Options 2, 3, and 5 build upon this foundation, providing practical measures such as exploring safer alternatives, adopting evidence-based strategies for existing asbestos, and emphasizing knowledge generation and access.

Option 4 acts as a cross-cutting element, centred around partnerships, resource mobilization, capacity-building, and awareness efforts. By fostering collaborations and enhancing awareness, Option 4 strengthens the overall capacity to implement legal, practical, and knowledge-based measures proposed in Options 1, 2, 3, and 5.

Together, these options collectively form a synergistic and mutually supportive strategy to effectively tackle the challenges associated with asbestos.

Introduction: addressing asbestos matters

While progress in minimizing adverse impacts of asbestos and ACMs has been made, more innovative, ambitious, and urgent action by all stakeholders and sectors is needed to protect present and future generations.

As detailed in Figure 1, exposure to asbestos may happen through different pathways and releases.

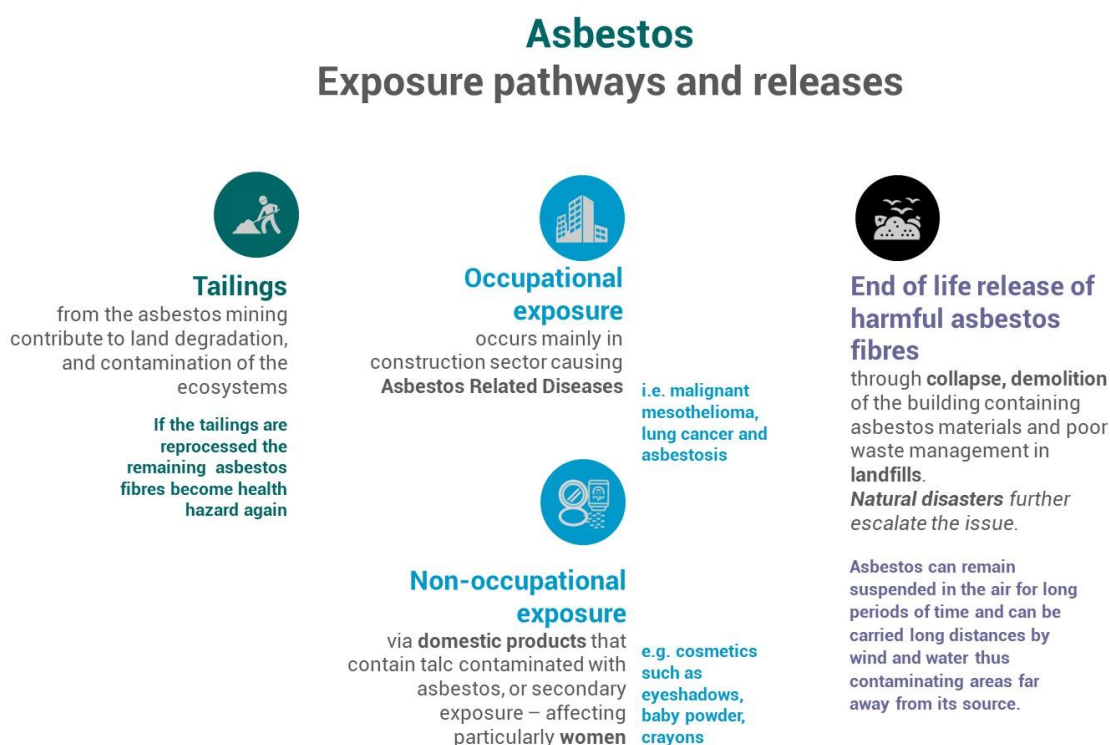


Figure 1. Asbestos exposure pathways and releases

(Sources: Landrigan 1992; Olsen *et al.* 2011; Emmett and Cakouros 2017; ILO 2019; Wallis *et al.* 2020; WHO 2021; Indiana Department of Environmental Management 2023; ILO 2023)

Globally as of 2016, occupational exposure to asbestos represented over 70 per cent of deaths from work-related cancers (WHO/ILO Joint Estimates). It caused an estimated 209,481 deaths and the loss of 3.97 million disability-adjusted life years from trachea, bronchus, and lung cancers; ovary cancer; larynx cancer; and mesothelioma (WHO and ILO 2021; Pega *et al.* 2022). Most of the workers exposed to asbestos belong to the construction sector, followed by waste management, and mining and quarrying related jobs (Mandrioli *et al.* 2018; European Commission 2022; Schlünssen *et al.* 2023).

Non-occupational exposures, often affecting women, are more likely to be under-recognized and underestimated (D'Agostin *et al.* 2018; Krówczyńska and Wilk 2019). Because of occupational gender differences, women have a higher risk of exposure from domestic products such as talc contaminated with asbestos, or secondary exposure to asbestos, for example from family members working with asbestos carrying residues home with them (Gordon *et al.* 2014). Studies have shown that over 60 per cent or greater of mesothelioma cases in women are likely attributable to non-occupational asbestos exposures (Rake *et al.* 2009; Lacourt *et al.* 2014).

Health impacts

All forms of asbestos can cause asbestos-related diseases (International Agency for Research on Cancer [IARC] 2012; WHO 2014a). This includes asbestiform minerals, such as erionite and antigorite and all forms of asbestos found as a natural contaminant of other minerals, e.g. talc, vermiculite and feldspar.

Exposure to asbestos causes cancers of the lung, larynx and ovary and asbestosis. Asbestos acts as a carcinogen in lung carcinoma and the combination of cigarette smoking and asbestos exposure greatly increases the risk of lung cancer (Villeneuve *et al.* 2012). Asbestosis is a respiratory disease marked by inflammation and scarring of the lungs that restricts lung expansion (Carbone *et al.* 2011). For all of these, the latency period from the time of first inhalation of asbestos to detectable disease is characteristically long; for mesothelioma, the risk of disease plateaus around 50 years after first exposure (Reid *et al.* 2014).

ILO has a long history in the identification of diseases as occupational for the purpose of their prevention and compensation. The List of Occupational Diseases Recommendation, 2002 (No. 194), adopted by the International Labour Conference in 2002, annexed a list of occupational diseases, which was revised in 2010 (ILO 2010). The causal relationship between work and disease is established based on clinical and pathological data, occupational background and job analysis, identification, and evaluation of occupational risk factors and of the role of other risk factors (ILO 2009).

Environmental effects

When construction, demolition, mining and manufacturing activities release asbestos into the environment, it contaminates the air (where it can be inhaled) (Bautista Sierra and Lamus Delgadillo 2019; Pena-Castro *et al.* 2023), water (where it can be ingested) (Cunningham and Pontefract 1971; Murr and Kloska 1976; Andersen *et al.* 1993; Varga 2000; Wang and Cullimore 2010; Bunderson-Schelvan *et al.* 2011; Kim *et al.* 2013; WHO 2014a; Di Ciaula and Gennaro 2016; Di Ciaula 2017; Punurai and Davis 2017; Van Laarhoven *et al.* 2021; Avataneo *et al.* 2022a; Avataneo *et al.* 2022b; WHO 2022; Zavašnik *et al.* 2022; Pena-Castro *et al.* 2023) and soil (where it can easily be distributed and redistributed into the air and water) (Ricchiuti *et al.* 2020). Asbestos can remain suspended in the air for long periods of time and can be carried long distances by wind or water before settling, thus contaminating areas far away from its source. Asbestos does not break down or biodegrade (Indiana Department of Environmental Management 2023).

Studies on the impact of asbestos on wild fauna and flora is scarce. The findings from studies conducted on animals mirror the established health impacts of asbestos in humans. Various tests were conducted to assess the carcinogenicity of asbestos through different administration methods in rats, hamsters, mice and humans. Inhalation of amosite, anthophyllite and tremolite resulted in mesothelioma and lung carcinomas in rats, while intrapleural administration led to mesothelioma. Additionally, intrapleural administration of amosite and anthophyllite induced mesothelioma in hamsters. Mice and rats subjected to intraperitoneal administration of amosite exhibited peritoneal tumours, including mesothelioma. Similarly, when administered through the same route, tremolite and actinolite induced abdominal tumours in rats (IARC 1987; Soffritti *et al.* 2003). These experimental results provide insights into the carcinogenic effects of asbestos and its various forms across different animal species. Asbestos fibres were observed in several wild animal species such as rodents living in and around asbestos contaminated areas (Puleio *et al.* 2013; Campopiano *et al.* 2020; Ingravalle *et al.* 2020). The anatomopathological analysis conducted by the Campopiano *et al.* 2020 study showed that 60 per cent of the examined animals had macroscopic lesions affecting their lungs.

Deterioration of ecosystems is evident in many asbestos mines, particularly closed/abandoned sites. For instance, in southeastern Quebec, asbestos mining residues cover an area of 2308 hectares. About 800 million tonnes of tailings are vestiges of this mining industry, along with socio-economic and environmental impacts resulting from mine closure. Ecological restoration of asbestos tailings and waste rock involves many considerations, including high costs and health risks related to asbestos dust exposure during the process (L'evesque *et al.* 2020).

Social and economic effects

Living with an asbestos-related disease is a burden for patients and their families, who experience a compromised quality of life. Costs associated with reduced quality of life cannot be compared or added to other economic costs. Over the lifetime of all patients with an asbestos-related disease, burden of disease costs is estimated to be US\$11 billion (Aljunid *et al.* 2020). For example, the annual global healthcare costs associated with asbestos are estimated to be US\$2.4–3.9 billion, excluding the additional costs of pain, suffering and welfare losses. In the United States alone, asbestos litigation costs have been estimated at another US\$2.3 billion per year (WHO 2018a).

Despite the significant costs of inaction on asbestos, some countries have not developed strong policies on asbestos phase out or control due to the assumed negative economic impact of such measures (WHO 2018a). However, an

assessment of the economic costs to society of asbestos production and use, published by WHO and the economic consulting company National Economic Research Associates [NERA] in 2017, showed no significant negative economic impact from asbestos bans or declines in asbestos production or use (WHO 2018a).

On the other hand, costs arising from the victims' compensations and legal actions against companies are significant. In some specific cases these compensation claims can be for large sums and may place the very survival of the company in doubt. The scale of this reimbursement and its economic impact depends both on the quantities of asbestos used in a given country and, above all, on the social security provisions in place for workers (International Social Security Association [IISA] 2006). For example, European Union legislation has implemented regulations aimed at safeguarding against and preventing asbestos exposure risks in work environments, however the legal frameworks on compensation for victims vary across European countries³ (Institute for International Research, Development, Evaluation and Counselling 2013).

Text box 1: Measures to support asbestos victims in Japan (*Source: Japan Research Office on Environment 2008, otherwise referred in particular*)

Two legal instruments address the health aspects of asbestos: the Industrial Accident Compensation Insurance Act (Industrial Accident Act), 1947, and the Act on Asbestos Health Damage Relief (Asbestos Relief Act), 2006. A worker who is exposed to asbestos and develops asbestos-related diseases such as asbestosis, lung cancer or mesothelioma is subject to compensation under the Industrial Accident Act. However, victims from household exposure or environmental exposure are not covered.

The Asbestos Relief Act was developed to fill the gap in the Industrial Accident Act to provide compensation to the asbestos victims and bereaved families. In fiscal year 2022, a total of 1,310 cases were covered under these two schemes (Japan Ministry of Health Labour and Welfare 2023).

Many countries have also introduced asbestos victim relief schemes to resolve the issue of victims of asbestos related diseases not receiving compensation through conventional legal orders (Lee *et al.* 2021).

Life cycle

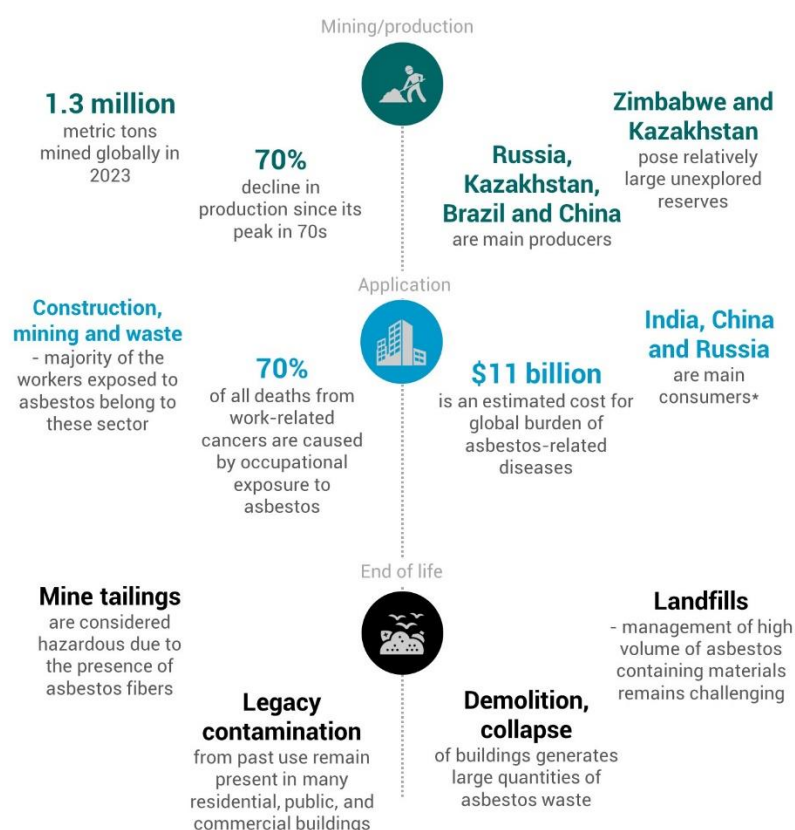
The asbestos life cycle and value chain encompass the entire process – from mining to processing, manufacturing and distribution of asbestos and asbestos-containing materials. This also includes installation, use, maintenance, and renovation, covering the various stages that asbestos-containing materials undergo from extraction or manufacturing to disposal or removal.

Figure 2 highlights key facts and figures about asbestos along value chain.

³ Most European Union Member States (except Estonia) have a specific occupational diseases compensation system. The specific systems give different benefits to those given for non-occupational diseases. In countries which have specific compensation systems, benefits are often more generous. Cash benefits may be higher, the way of calculating the pension (in case of permanent injury) is more favourable to the victim, and other benefits can be offered, such as rehabilitation. In those countries that do not have a specific system of compensation, a temporary loss of ability to work is covered under the general health insurance system, while disability and death are covered by the relevant disability or pension insurance provisions (European Commission 2013). Croatia and Slovenia, however, have a specific compensation system for occupational asbestos-related diseases (Institute for International Research, Development, Evaluation and Counselling 2013).

Asbestos along value chain

Key facts and figures



* The asbestos consumption is estimated by comparing country's supply (production and/or imports of asbestos material) minus reported exports. According to the data from 2022, India is the leading asbestos consumer, followed by China and Russia (consult Figure 3 for more details)

Figure 2. Asbestos along value chain – key facts and figures

(Sources: Godish 1989; LaDou 2004; Ramazzini 2010; International Agency for Research on Cancer [IARC] 2012; WHO 2014a; Henderson and Leigh 2017; Rackley 2017; Spasiano and Pirozzi 2017; Aljunid et al. 2020; United States Geological Survey [USGS] 2023; World Bank, United Nations Conference on Trade and Development, International Trade Centre, United Nations Statistics Division and World Trade Organization [WTO] 2023a and 2023b)

At its peak in the 1970s, global asbestos production was as high as 4.8 million metric tons. Thanks to accumulated knowledge on its adverse health effects, many countries strengthened the regulations on asbestos use. In 2023, the world mine production of asbestos was estimated to be approximately 1.3 million metric tons (United States Geological Survey [USGS] 2023). The Russian Federation and Kazakhstan produce the largest volumes of asbestos (700,000 and 230,000 metric tons respectively), followed by Brazil (with 190,000 metric tons) and China (130,000 metric tons) (USGS 2023).

Global asbestos reserves are estimated to be large, even though available information is insufficient to make accurate estimates for many countries (USGS 2023). In 2021, top exporters of asbestos were the Russian Federation (600,569 metric tons), Kazakhstan (232,366 metric tons) and Brazil (153,571 metric tons) (World Bank [WB], United Nations Conference on Trade and Development [UNCTAD], International Trade Center (ITC), United Nations Statistical Division (UNSD) and World Trade Organization [WTO] 2023a). Top importers of asbestos were India (409,987 metric tons), Indonesia (130,038 metric tons) and China (140,088 metric tons) (WB, UNCTAD, ITC, UNSD and WTO 2023b).

Zou et al. 2023 analysed 66,156 trade records from the United Nations Comtrade database for the period of 2004–2019 covering 46 chemicals or groups listed under the Rotterdam Convention to look into the continuing large-scale global

trade and illegal trade of highly hazardous chemicals. From that study, the top trade flows of asbestos materials in 2022 can be estimated (see Figure 3).⁴ Currently, the same HS code 2524.90 is assigned for actinolite, anthophyllite, amosite, chrysotile and tremolite. The crocidolite trade shows a clear declining tendency (for example, about 0.3 kilo tonnes in 2019, which is 2 per cent of the trade volume in 2010). By contrast, trade activities for the other five varieties remain constant since 2013 – at an annual trade of around 1 megaton – with chrysotile being dominant.

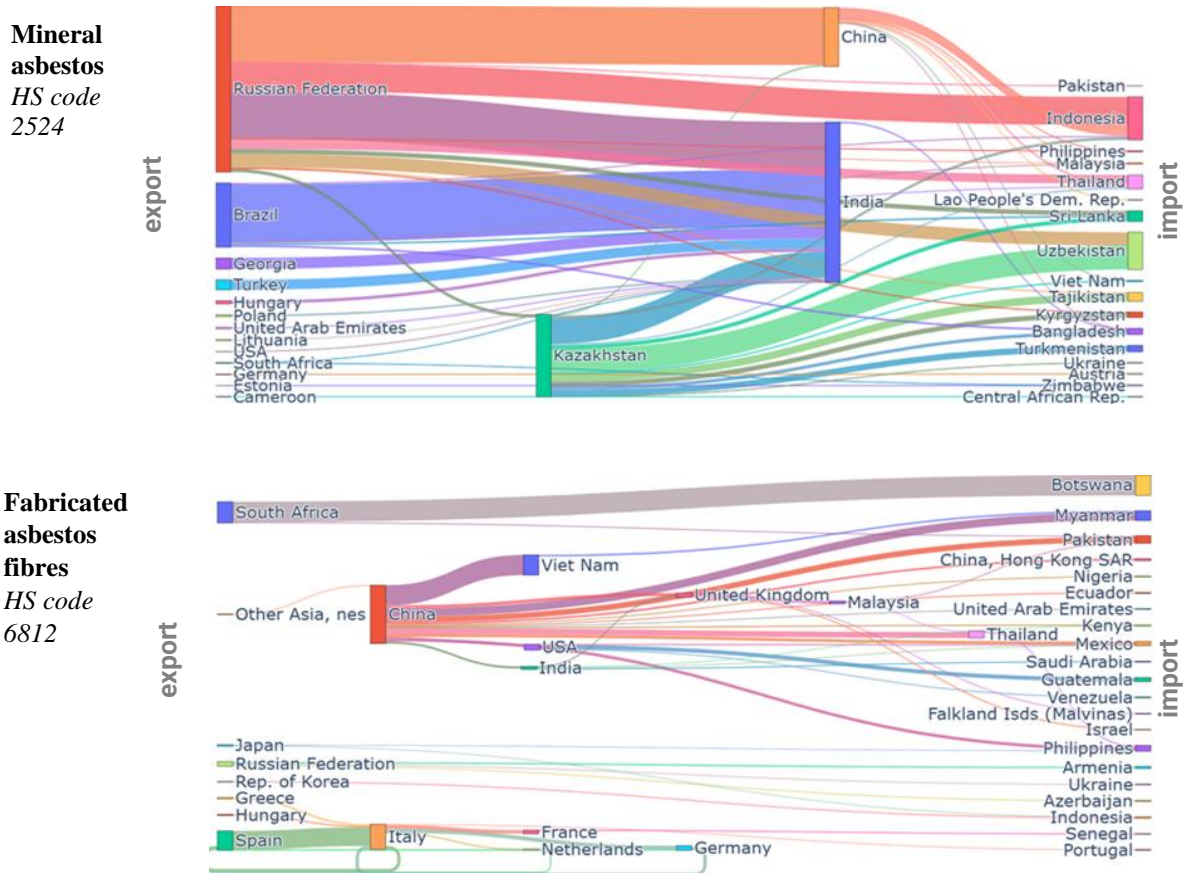


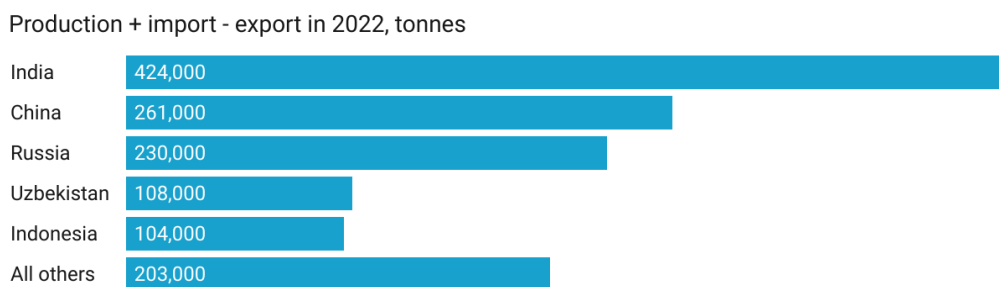
Figure 3. Top trade flows of asbestos materials in 2022

(Source: Zou et al. 2023)

The major use of asbestos globally is in asbestos cement construction materials such as cement pipe and roofing sheets (WHO 2014b; USGS 2023). To better understand the trends in use and trade of asbestos, the concept of material consumption could be applied. The asbestos consumption is estimated by comparing country’s supply (production and/or imports of asbestos material) minus reported exports.

Figure 4, presenting data from 2022, shows India as the leading asbestos consumer, followed by China and the Russian Federation.

⁴ Five varieties of asbestos are currently listed under the Rotterdam Convention (actinolite, anthophyllite, amosite, crocidolite and tremolite). The listing of chrysotile asbestos in the Convention has been considered by the governing body of the Convention since its 3rd meeting in 2006.



Data source: USGS Mineral Commodity Summaries 2023

Figure 4. World asbestos consumption

(Source: USGS Mineral Commodity Summaries 2013)

The waste materials left over from asbestos mining operations include asbestos tailings, which are typically considered hazardous due to the presence of asbestos fibres (USGS 2023). The quantity of asbestos mine tailings available globally was estimated in 2017 to be in the range from two to six billion tonnes (Rackley 2017). In some cases, the tailings might be reprocessed to extract remaining asbestos (USGS 2023).

Asbestos is part of the daily life of the population as asbestos-containing materials are present in many buildings constructed and renovated before the 1990s (Thives *et al.* 2022). Large quantities of asbestos remain a legacy from past use in construction of many residential, public and commercial buildings (Ramazzini 2010). As of 2009, there were about 150 million m² of asbestos-based products in use and more than two thousand million m² of cement-asbestos roofings (Gualtieri *et al.* 2009). For example, Japan found substantial asbestos presence in public facilities including schools, hospitals, wholesale markets, train stations and bus terminals (Japan Research Office on Environment 2008). In the United States of America, there was asbestos in approximately 840,000 public and commercial buildings including schools (Powell *et al.* 2015). In the Republic of Korea, a large amount of imported asbestos was used in the roofing material of a government-led project to remodel old buildings during the 1970s (Choi *et al.* 1998), much of which was still in place as of the start of this decade (Kim *et al.* 2020). The Australian government estimated that the disposal flow of asbestos is estimated to peak at about 167 thousand tons in 2030 (Asbestos Safety and Eradication Agency of Australia [ASEA] 2021).

When buildings that were constructed or refurbished with asbestos containing materials, are demolished or collapsed it generates large quantities of asbestos waste, leading to the release of harmful asbestos fibres (Kim *et al.* 2015). For example, more than 5,000 tons of asbestos waste was discovered after the collapse of the World Trade Center in New York, and the amount of released asbestos fibres reached 555 times the acceptable limit (Klotter 2002).

Natural disasters further escalate the issue⁵ by exposing firefighters, first-aid responders and clean-up workers to the harmful asbestos possibly present in the damaged buildings (Fire Safe Council Santa Barbara County 2023). According to a study conducted in Poland, at the current removal rate of asbestos-containing products, these materials are unlikely to be eliminated from the country by the established deadline (end of 2032) and are likely to persist for at least 27 years and up to 193 years, depending on the specific province. On a national scale, an average removal rate indicates that a total of 83 years would be required for the comprehensive elimination of asbestos products (Klojzy-Karczmarczyk and Staszczak 2022).

Asbestos waste materials from demolition or removal are often disposed of in landfills and rarely disposed of in its pure fibrous form – rather it is commonly combined within a building material matrix, e.g. concrete. This greatly increases the volume of asbestos containing materials to landfill. Assuming an average asbestos concentration of five per cent, the total contaminated waste ultimately requiring disposal is estimated to be about four billion tonnes globally (Wallis *et al.* 2020). Deteriorating asbestos-containing building materials and continuing use of asbestos in some countries will only add to this burden (Wallis *et al.* 2020).

⁵ For example, the 2019 Tropical Cyclone Idai caused catastrophic damage and a humanitarian crisis in Mozambique, Zimbabwe and Malawi, leaving more than 1,300 people dead and many more missing. The cyclone left a high exposure of hazardous waste, primarily asbestos from lusalite sheets (ILO 2019). Construction workers were particularly exposed when clearing up older damaged buildings (ILO 2023).

Several factors drive continued asbestos mining and use and hinder its environmentally sound management. First, countries continue to use asbestos, claiming that it is economical and useful (Frank 2020). Weak or inadequate asbestos regulations can enable its continued use in certain industries or products (Rotterdam Convention Secretariat 2023). Secondly, asbestos-related diseases, such as mesothelioma and asbestosis, have a long latency period, sometimes spanning several decades (French Institute for Public Health Surveillance 2011; Huh *et al.* 2022). This delay can make it challenging to link current exposure to future health problems, leading to complacency (Luus 2007). Limited awareness about the dangers of asbestos exposure and the existence of safer alternatives also contributes to its continued use. While the awareness is lacking in some, in others, the issue of asbestos is seen as something of the past, even as many buildings and industrial facilities constructed before asbestos bans still contain asbestos-containing materials. Removing asbestos from existing structures is extremely costly and complex (Quezada *et al.* 2018).

Asbestos regulations and bans: status and lessons learned

The ILO Asbestos Convention, 1986 (No. 162), together with other international labour standards, including several relevant conventions and recommendations⁶, provide a solid legal bases as well as practical guidance for comprehensive preventive measures at the national and enterprise levels to protect workers and prevent asbestos-related diseases. Convention No. 162 applies to all activities involving exposure of workers to asbestos in the course of work. The key provisions concern the replacement of asbestos or of certain types of asbestos or products containing asbestos with other materials or products evaluated as less harmful, the total or partial prohibition of the use of asbestos or of certain types of asbestos or products containing asbestos in certain work processes, and measures to prevent or control the release of asbestos dust into the air and to ensure that the exposure limits or other exposure criteria are complied with and also to reduce exposure to as low a level as is reasonably practicable. Furthermore, Convention No. 162 provides that “employers shall dispose of waste containing asbestos in a manner that does not pose a health risk to the workers” and “appropriate measures shall be taken by the competent authority and by employers to prevent pollution of the general environment by asbestos dust released from the workplace.”⁷

The Rotterdam Convention includes all types of asbestos of the amphibole group (namely actinolite, amosite, anthophyllite, crocidolite and tremolite) in its Annex III of chemicals that have been banned or severely restricted for health or environmental reasons by two or more Parties and which the Conference of the Parties (COP) to the Rotterdam Convention has decided to subject to the prior informed consent (PIC) procedure. Chrysotile asbestos has been considered by the COP for inclusion in Annex III since its third meeting in 2006. However, Parties have not reached consensus on the listing of chrysotile asbestos, including at the eleventh meeting in 2023, when the COP decided to defer further consideration of the matter to its twelfth meeting.

Under the Basel Convention, Annexes I and VIII on categories of wastes to be controlled include entry Y36 Asbestos (dust and fibres) and entry A2050 Waste asbestos (dust and fibres). Wastes listed under any category contained in Annex I and Annex VIII are hazardous wastes, unless they do not possess any of the characteristics contained in Annex III and are subject to the Convention’s provisions, namely that transboundary movements of these wastes are controlled through the Convention’s prior informed consent procedure, the generation of these wastes is reduced to a minimum, and their environmentally sound management (ESM) is promoted.

The World Health Organization is also committed to working with countries along the following four strategic directions (WHO 2018a): 1) By recognizing that the most efficient way to eliminate asbestos-related diseases is to stop the use of all types of asbestos; 2) By providing information about solutions for replacing asbestos with safer substitutes and developing economic and technological mechanisms to stimulate its replacement; 3) By taking measures to prevent exposure to asbestos in place and during asbestos removal; 4) By improving early diagnosis, treatment and rehabilitation services for asbestos-related diseases and establishing registries of people with past and/or current exposure to asbestos.

⁶ In particular the Occupational Cancer Convention and Recommendation, 1974, the Working Environment (Air Pollution, Noise and Vibration) Convention and Recommendation, 1977, the Occupational Safety and Health Convention and Recommendation, 1981, the Occupational Health Services Convention and Recommendation, 1985, the list of occupational diseases as revised in 1980 appended to the Employment Injury Benefits Convention, 1964, as well as the Code of practice on safety in the use of asbestos, published by the International Labour Office in 1984, and establishes the principles of national policy and action.

⁷ ILO Asbestos Convention text available at:

https://www.ilo.org/dyn/normlex/en/f?p=NORMLEXPUB:12100:0::NO::P12100_ILO_CODE:C162.

At the national level, a range of options for managing the import, manufacture, sale, use and reuse of asbestos and asbestos containing materials has been applied. According to the International Ban Asbestos Secretariat there are 69 countries that have banned asbestos to date (see Figure 5). In some other cases, countries have not officially banned asbestos but have ratified ILO conventions that aim to protect workers and prevent asbestos-related diseases.

To ensure the compliance with the ban and to manage the related asbestos issues, various measures have been documented at the national level, including:

- Development of national strategy roadmaps, including National Asbestos Profile (NAP)⁸ as an internationally standardized instrument that is designed to define the baseline situation of a country and measure its progress towards eliminating asbestos-related diseases (Arachi *et al.* 2021) (see text box 2).
- Establishment of the national inventories, e.g. with an aim to 1) record exposure and health impacts^{9,10}; 2) maintain public record of buildings that contain asbestos¹¹; or 3) track companies that might produce.¹²
- Creation of the national coordinating committee on asbestos among relevant ministries (see text box 4).
- Awareness campaigns and providing public access to information on the asbestos contamination ways to prevent exposure.¹³
- Use of occupational disease lists (ODLs) as essential legal mechanisms for recognizing exposure to occupational hazards and assisting in settling compensations.¹⁴

⁸ Including: Australia, Bangladesh, Bulgaria, Cambodia, Germany, India, Indonesia, Japan, Lao, North Macedonia, Mongolia, Nepal and Philippines. E.g. Australia developed a National Strategic Plan for Asbestos Awareness and Management (Asbestos National Strategic Plan) to eliminate asbestos-related diseases in by preventing exposure to asbestos fibres. The Asbestos National Strategic Plan 2019–2023 builds on the previous plan’s progress. It complements and enhances existing asbestos policies, plans and actions at all levels of government. Its priorities are (1) asbestos awareness, (2) identification, (3) removal and (4) international collaboration (Asbestos Safety and Eradication Agency of Australia [ASEA] 2023).

⁹ E.g. Australian National Asbestos Exposure Register (NAER) that records information for members of the community who may have been exposed to asbestos, for their future reference (Asbestos Safety and Eradication Agency of Australia [ASEA] 2023a). However, as the NAER is voluntary and self-reported and the information recorded is based on each registrant’s recollection of events, the data does not provide an accurate picture of asbestos exposures or asbestos-related disease in Australia (Asbestos Safety and Eradication Agency of Australia [ASEA] 2022a).

¹⁰ The French National Mesothelioma Surveillance Program (NMSP) was established in 1998 by the National Institute for Health Surveillance (InVS). Its objectives are to estimate the trends in mesothelioma incidence and the proportion attributable to occupational asbestos exposure, to help improve its diagnosis, to assess its compensation as an occupational disease and to contribute to research (Goldberg *et al.* 2006).

¹¹ In Canada, the National Asbestos Inventory lists all buildings owned or leased by Public Services and Procurement Canada (PSPC) and indicates whether they contain asbestos as of December 2022 (Government of Canada 2023).

¹² In the United States, the Asbestos Information Act (Public Law 100-577) helped to provide transparency and identify the companies making certain types of asbestos-containing products by requiring manufacturers to report production to the Environment Protection Agency (US Environment Protection Agency [EPA] 2023).

¹³ For example Worksafe New Zealand, the primary agency overseeing asbestos management in New Zealand, provides awareness resources on the official Worksafe government site, covering topics such as working with asbestos, guidance for homeowners and landlords, licensing for asbestos removal companies, asbestos disposal, importing asbestos-containing materials, and personal protective equipment - <https://www.worksafe.govt.nz/topic-and-industry/asbestos/>. Additionally, the New Zealand Demolition and Asbestos Association have established a website to furnish tradespeople and homeowners with clear information on mitigating the risks of asbestos exposure. The platform combines regulatory requirements with practical advice on asbestos identification and safe work practices to minimize exposure - <https://www.asbestosawarenz.com>.

¹⁴ E.g. European Union (EU) Member States in Central and Eastern Europe (CEE) have adopted the EU list of occupational diseases into their own legal framework.

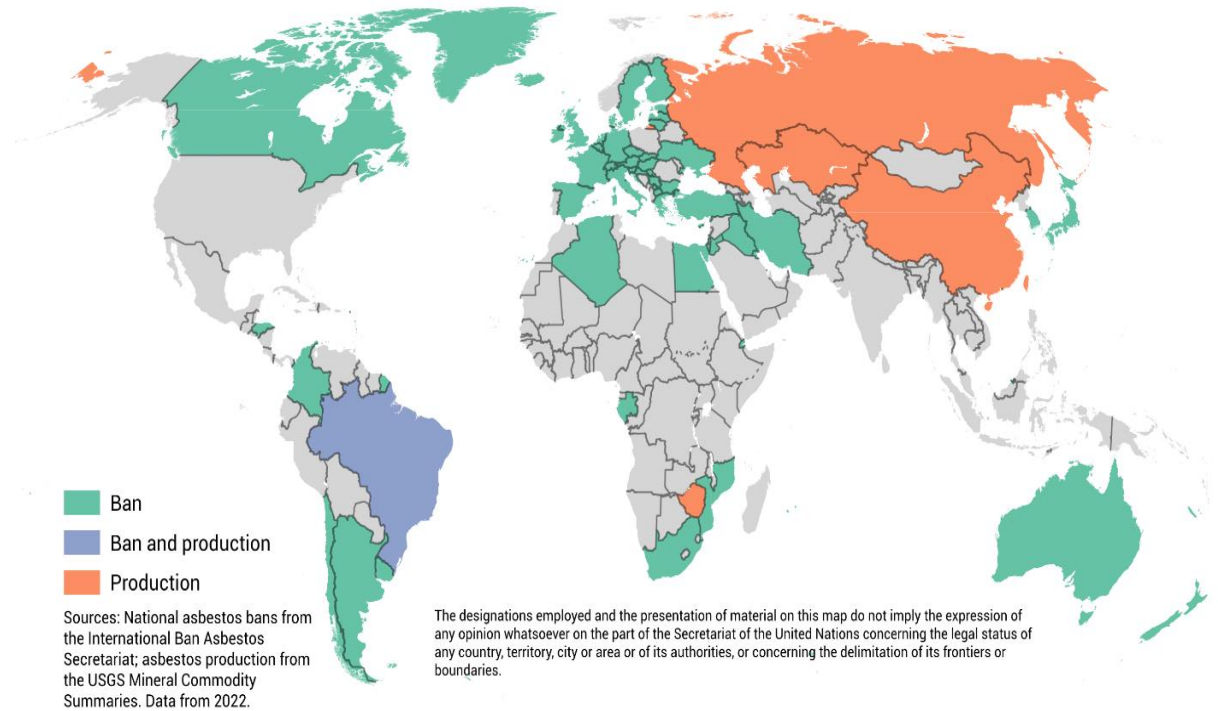


Figure 5. Global Asbestos Bans and Production¹⁵

(Sources: National asbestos bans from the International Ban Asbestos Secretariat 2022; Asbestos production from the USGS Mineral Commodity Summaries 2022)

Text box 2. National Action Plan to address asbestos and asbestos containing materials – Poland case study (Source: Ministry of Development and Technology 2024)

In Poland, a comprehensive legal framework¹⁶ prohibits the production, trade and introduction of products containing asbestos within the national customs territory. Recognized in EU documents¹⁷, Poland is acknowledged as a leader in endeavours to eliminate asbestos within its borders, reflecting the country's commitment to upholding high standards of environmental safety.

However, the significant challenge in the asbestos removal process lies in the widespread distribution of asbestos-containing products throughout Poland, particularly in residential and agricultural structures. This extensive dispersion poses a considerable obstacle to the overall asbestos removal efforts, complicating the task of addressing asbestos-related risks in various communities.

¹⁵ Brazil imposed a ban in 2017, but a state law under dispute in the courts has been keeping the asbestos mine operational. On February 23, 2023, Brazil's Supreme Court (STF) upheld a decision banning the commercial exploitation of asbestos (source: Brazil Asbestos Ban Upheld! (ibasecretariat.org)).

¹⁶ These regulations, outlined in the Act of June 19, 1997, the Labor Code of April 26, 1974, the Environmental Protection Law of April 27, 2001, and the Waste Act of December 14, 2012, and their associated implementing acts, establish stringent measures for asbestos protection.

¹⁷ Opinion of the European Economic and Social Committee on 'Freeing the EU from asbestos' (2015/C 251/03) – "Today, Poland is the only EU country that has established a nation-wide programme for the removal of all existing asbestos estimated at EUR 10 billion up to 2030, with a clear timeframe and the corresponding financing through a mixture of public (State, EU programmes) and private (owners, territorial associations, etc.) means. This type of initiative needs to be launched in all EU countries." Opinion of the European Economic and Social Committee on 'Working with Asbestos in Energy Renovation' (own-initiative opinion) (2019/C 240/04) – "Poland is a notable exception: the country has an ambitious asbestos abatement programme that enjoys public support and is facilitated by the existence of a publicly accessible register for asbestos." European Parliament resolution of 20 October 2021 with recommendations to the Commission on protecting workers from asbestos (2019/2182(INL)) – "Welcomes the fact that several Member States and regions are currently pursuing ambitious plans to remove asbestos from the built environment with clear timelines, including the Netherlands, Poland and Flanders."

From 2004 to 2013, extensive research assessed asbestos fibres concentrations in the air across 949 municipalities in Poland, encompassing 1634 measurement points.¹⁸

The Programme for Asbestos Abatement in Poland, executed from 2009 to 2023, has demonstrated significant achievements. This programme involved extensive training, reaching 196 thousand individuals, subsidies for inventory initiatives, clean-up of former asbestos-producing plants, financial support programmes for product removal, and educational activities for construction-related fields. The Amiantus initiative targeted former employees to detect asbestos-related diseases, contributing to occupational health reporting.

As of January 2024, the Asbestos Database has inventoried 8.6 million tons of asbestos-containing products, with 1.7 million tons of asbestos waste neutralized, reflecting the programme's substantial impact on reducing asbestos-related risks and enhancing environmental and public health in Poland.

Lessons learned

An examination of the economic effects of asbestos bans (using country-level data) concluded that as countries have shifted away from asbestos, no observable negative economic impact; and that continued use of asbestos is expected to result in substantial costs, including health costs as well as remediation/removal costs and potential litigation costs (Allen *et al.* 2018).

Text box 3. Economic transition after the asbestos ban in Quebec, Canada (Source: Allen *et al.* 2018)

At its peak in 1970, Canada produced 1.5 million metric tons of asbestos (43 per cent of the world total). Most of the Canadian asbestos production took place in one province – Quebec. The last two asbestos mines in Canada, both located in Quebec, closed in 2011. After mines closure, the Government of Canada launched initiative to support the economic transition of communities economically linked to the chrysotile asbestos industry. The initiative was in effect until 2020 and had a budget of C\$50 million for projects to create jobs in the secondary and tertiary sectors. The town of Asbestos in the Estrie (Eastern Townships) region, for example, received funding for construction of a new road to facilitate expansion of an industrial park and the renovation of regional park reception centre to help accommodate visitor traffic and develop the tourism industry.

In some cases, endeavours at the national level—frequently led by health authorities and local experts—have encountered challenges in implementing effective controls and/or bans on asbestos use, due to a lack of consensus within the government, underscoring the complexities of multisectoral governance (Kanchanachitra *et al.* 2018).

Text box 4: Whole of government approach to eliminating asbestos-related diseases - case studies

In Australia, the Asbestos Safety and Eradication Agency was established as an independent entity through the Asbestos Safety and Eradication Agency Act 2013. This demonstrates a dedicated commitment to allocate sufficient resources for the eradication of asbestos-related diseases. Its role is to coordinate the implementation of the Asbestos National Strategic Plan. This Plan outlines a phased approach to eliminating asbestos-related diseases in Australia and establishes a framework for all governments to work together to improve asbestos awareness and the safe and effective management, removal and disposal of asbestos. On the 7 December 2023, the agency's functions were expanded to include silica through an amendment of the Asbestos Safety and Eradication Agency Act 2013. The agency's name was also changed to the Asbestos and Silica Safety and Eradication Agency (ASEA 2024).

¹⁸ The results indicated that approximately 38 per cent of locations had low concentrations (up to 400 fibres/m³), 44 per cent exhibited moderate concentrations (400 to 1000 fibres/m³), and 18 per cent recorded high concentrations exceeding 1000 fibres/m³. These findings provide crucial insights into the distribution and levels of asbestos fibres, informing efforts to manage and mitigate airborne asbestos exposure.

In Finland, the Finnish Institute of Occupational Health serves as the lead agency for implementing the Asbestos Programme, owing to its primary role in handling issues related to asbestos exposure in the workplace. Despite being the lead agency, they opted for a collaborative approach, forming a multi-agency task force composed of representatives from six relevant ministries and government agencies to shape and execute the legal reform process (Secretariat of the Pacific Regional Environment Programme [SPREP] 2021).

In the United States of America, the Environmental Protection Agency (EPA) enforces laws and issues regulations aimed at safeguarding the public from asbestos exposure. EPA's mandate covers toxic substances, hazardous air pollutants and hazardous waste. Other agencies, such as the Occupational Safety and Health Administration, Consumer Product Safety Commission and Mine Safety and Health Administration also implement asbestos regulations in line with their respective mandates (US EPA 2024).

Even if intentional commercial uses of asbestos are banned and handling of legacy products is regulated, exposure is possible when handling other minerals (e.g. talc, dolomite and olivine) where asbestos occurs as an impurity¹⁹. As an illustration, a study in 2004 revealed that due to the methods and locations of talc mining, mineral deposits used in the production of goods sold in the United States of America consistently shown contamination with amphibole asbestos, including tremolite and anthophyllite (Van Gosen *et al.* 2004). Asbestos contamination was found in powdered cosmetics (such as eyeshadows), baby powder (US PIRG 2018), crayons and some vermiculite products²⁰ (United States National Cancer Institute [NCI] 2023). For instance, European Union, following the ban on all use of asbestos, in 2021 adopted a supplementary measure – a resolution calling for a European strategy for the removal of all asbestos (European Commission 2022). It is therefore essential to monitor and control any unintentional asbestos contamination of consumer goods, e.g. by requesting sellers of talc and soapstone to provide proof that no asbestos can be detected in the material with the specified analytical methods (European Commission 2022).

Exploring safer alternatives

Since many countries have banned or heavily regulated asbestos use, safer alternatives^{21,22} have been developed for most applications. As in any case of chemical substitution, supplementary research (including life-cycle assessments (LCA)) and monitoring of the asbestos alternatives is warranted to avoid any unintended health and environmental consequences and regrettable substitutions. To make well-informed decisions on asbestos replacement, it is essential to conduct a LCA of potential alternatives. This assessment aims to comprehensively evaluate the environmental, economic, and technical performance of materials free from asbestos.

Recently, the health hazards of asbestos substitutes have been considered and much additional research is required. However, only some of the substitute materials have been assessed for health hazards, and health hazard data has not been sufficient in many cases. The examination of alternatives in a study conducted by Park (2018) concluded that initiatives should be undertaken to reduce workers' exposure to replacement materials devoid of asbestos.

¹⁹ For example: A Dutch investigation of talc in cosmetic products analysed 232 cosmetic products for the presence of asbestiform talc. Two of the products were found to contain asbestiform tremolite fibres in concentrations up to 230 mg/kg and 40 mg/kg product, respectively (Netherlands Food and Consumer Product Safety Authority [NVWA] 2018). And a German investigation of 57 talc powders (technical and cosmetic), asbestos fibres were detected in 13 samples. In ten of the samples the weight content of asbestos ranged from 0.001 to 0.073%. In one talc powder analysed at two occasions, weight contents of 0.18 and 0.19% respectively (European Commission 2022).

²⁰ Mining of asbestos-contaminated vermiculite in Libby, Montana, resulted in an epidemic of asbestos-related disease in that community, and output from the mine is estimated to be installed as insulation in an estimated 15 to 30 million homes (US Food and Drug Administration 2023).

²¹ http://www.ibasecretariat.org/bc_subst_asb_cem_constr_prods.php

²² In the context of this paper, a safer alternative means replacing a hazardous substance with one which poses less or no risk. This may mean changing a production process, substituting a chemical or material, redesigning a product, or making a system change. The safer alternative transition is to identify functionally equivalent alternatives that meet the performance needs of a product while eliminating the hazardous chemical. Transitioning to safer chemicals can be complex. It is crucial that any change towards safer alternatives is made while avoiding regrettable substitution, meaning the replacement of a toxic chemical with one that has either unknown or greater toxic effects.

According to patent data²³ from the United States and Europe, fibrous materials may be considered as an alternative to asbestos. There are many kinds of fibrous materials, which can be classified into synthetic and natural fibres²⁴. However, recent studies brought to light evidence on health hazards, including links to cancers, of fibrous materials used as asbestos substitutes.²⁵

The substitutes for asbestos material, as identified by Leprince in 2007, include:

- a) In the building sector:
 - Mineral wool and ceramic fibre as substitute for asbestos containing insulation or soundproofing.
 - Synthetic vitreous fibres or clay as a substitute for sheets and boards containing asbestos.
 - Cellulose, polypropylene, polyvinyl alcohol fibre, aramid and glass fibres as substitute for asbestos products in cement (Park 2018).
- b) In the textile sector:
 - Polyethylene, polypropylene, polyamide, carbon and glass fibre as substitutes for textile containing asbestos.

It is important to note that these alternatives have not been fully assessed for their overall environmental impacts (e.g. with LCA), so while they are not asbestos, and for some exists evidence of reduced health hazards, they might generate trade-offs with other environmental impacts (e.g. increased greenhouse gas emissions, impacts on biodiversity and water scarcity).

The WHO has assessed the hazards of 14 types of asbestos substitute materials, including para-aramid, attapulgite and carbon fibre (WHO 2005). Also, Harrison *et al.* 1999 has discussed the health hazards of para-aramid, polyvinyl alcohol and cellulose in comparison to chrysotile. According to the studies, the major characteristics related to the health hazards of fibre are its dose, dimensions (especially diameter) and durability.

In summary, even though some substitute materials have been assessed for health hazards, efforts should be enhanced to further assess and to ensure that the substitutes themselves do not have other negative environmental, social or health impacts (Park 2018).

²³ According to patent resources in the United States and Europe, asbestos substitutes have constantly been developed since before 1980 (Forte *et al.* 1975; Fox *et al.* 1979; Bartram *et al.* 1980; Harper *et al.* 1981; Limdeman *et al.* 1982; Malcolm *et al.* 1982; Albertson *et al.* 1983; Brunt *et al.* 1983; Mudd 1983; Tracy *et al.* 1983; Washabaugh 1983; Lancaster *et al.* 1985a; Lancaster *et al.* 1985b; Dougherty *et al.* 1986; Pallo *et al.* 1986; Genba *et al.* 1987; Bauer *et al.* 1990; Wargin 1990; Attard *et al.* 1994; Bachot *et al.* 1995; Bauer *et al.* 1995; Kusuyama 1995; Nakao 1995; Santaren Rome *et al.* 1996; Bachot *et al.* 1997; Latty *et al.* 1997; Bruno Hennecken *et al.* 2002; Velayutha 2002; Krowl 2005). An asbestos-free drywall joint compound was developed in 1975 (Forte *et al.* 1975), an asbestos-free tape sealant was developed in 1979 (Fox *et al.* 1979), and an asbestos-free friction material was developed in 1980 (Bartram *et al.* 1980). An asbestos-free gasket was developed in 1982 (Limdeman *et al.* 1982) and a method of manufacturing an asbestos-free glass fibre reinforced product was developed in 1983 (Brunt *et al.* 1983). Flexible sheet material suitable for use in the manufacture of asbestos-free gaskets was developed in 1985 (Lancaster *et al.* 1985b) and a method of manufacturing aramid-containing friction materials in 1986 (Dougherty *et al.* 1986). In 1996, a fibre-reinforced building material was developed using sepiolite (Santaren Rome *et al.* 1996); in 2002, a press pad composed of an asbestos-free material was developed (Bruno Hennecken *et al.* 2002).

²⁴ Synthetic fibres can be classified into organic and inorganic fibres; synthetic organic fibres include polyamide fibre, polyolefins fibre, polyester fibre, polyurethane fibre, and polyvinyl fibre, and synthetic inorganic fibres include glass filaments, glass wool, refractory ceramic fibres, rock wool, and slag wool fibre. Natural fibres include natural organic fibres such as cotton and hemp and natural inorganic fibres such as attapulgite, erionite (zeolite), nemalite (fibrous brucite), sepiolite, and wollastonite (International Life Sciences Institute [ILSI] 2005, Park 2018)

²⁵ Erionite fibre, which is a mineral fibre, causes malignant mesothelioma and has been classified into Group 1 (carcinogenic to humans) by the International Agency for Research on Cancer (IARC) (International Agency for Research on Cancer [IARC], 2012). Also, refractory ceramic fibres are classified into Group 2B (possibly carcinogenic to humans) by the IARC (IARC 2002) and Group A2 (suspected human carcinogen) by the American Conference of Governmental Industrial Hygienists (ACGIH) as they can cause lung fibrosis (American Conference of Governmental Industrial Hygienists [ACGIH] 2016).

Existing evidence of the adverse impacts of asbestos calls for urgent action

Considering the existing evidence, five options for addressing asbestos contaminants in products and the environment have been suggested to guide relevant stakeholders such as governments, national agencies, industry, academia, civil society organizations and international organizations.

These five options are aligned with the strategic objectives and targets of the Global Framework on Chemicals (GFC). The GFC provides a multi-sectorial and multi-stakeholder platform that is essential in addressing asbestos contamination. It is driving the transformational shift towards innovation to supply safer and more sustainable products and advancement of sustainable consumption and production patterns, including through resource efficiency and circular economy approaches.

In considering the options presented below, it should be noted that legally binding obligations apply for Parties to relevant multilateral environmental agreements, including the Basel and Rotterdam Conventions, and the ILO Conventions, as explained earlier in this paper. Parties may wish to take further action to strengthen capacities for the implementation of relevant provisions.

Integrating these five options—customizing them to suit specific regional and national conditions—is crucial for the efficient handling and alleviation of risks linked to asbestos contamination in both products and the environment.

Option 1: Reinforcing legal frameworks and institutional mechanisms to bolster the elimination of asbestos-related diseases by stopping the use of all types of asbestos and by managing asbestos risks across its entire life cycle. While advancements have been achieved, as indicated by the spread of asbestos bans and restrictions, it is noteworthy that only 69 countries currently enforce asbestos prohibitions (see Figure 5). This emphasizes the need to intensify efforts in implementing asbestos bans in the remaining nations, and further enhance effective implementation of the asbestos related provisions under Basel and Rotterdam Conventions and ILO Conventions. Asbestos containing materials are still responsible for severe human diseases, particularly in areas where there is a lack of coordinated asbestos management plans, reduced awareness about asbestos health risks, or even a delay in the implementation of asbestos-ban. Such issues may be more prevailing in developing countries (Thives *et al.* 2022).

The management of asbestos at the national level typically involves diverse government agencies responsible for regulations, enforcement, labour and health-related aspects. The structure and responsibilities of these agencies can vary across countries. Some nations may even have a dedicated national agency or department exclusively addressing asbestos-related issues (Secretariat of the Pacific Regional Environment Programme [SPREP] 2021). Nevertheless, government agencies are at different stages of maturity in relation to a systematic approach to asbestos removal and only a few have planned, prioritised removal schedules (ASEA 2022b). Hence, fostering enhanced coordination among relevant agencies is imperative for the implementation of a comprehensive and effective asbestos management.

Option 2: Investigating and adopting safer alternatives to asbestos and incorporating innovative and sustainable solutions throughout product value chains, using a life cycle approach. This approach aims to maximize benefits to human health and the environment while actively mitigating risks. In instances where prevention is not feasible, the focus is on minimizing potential risks. Many nations have either prohibited or tightly regulated the use of asbestos, with safer alternatives, having been devised for various purposes. Nonetheless, there is growing concern about the health hazards associated with some asbestos substitutes, necessitating further research due to insufficient health hazard data in many instances. Hence, it is imperative to conduct a thorough life cycle assessment to evaluate the environmental, economic, and technical attributes of materials that are asbestos-free. Also, alternative technologies for dealing with legacy asbestos are available, but it is worthwhile to explore innovative and sustainable options for asbestos waste management. This exploration should take place where these alternatives are proven to be viable and are accompanied by suitable policy and regulatory changes (Khatib *et al.* 2023).

Option 3: Adopting evidence-based strategies to deal with asbestos already in use and to tackle the legacy uses and exposure to asbestos. This includes meticulous asbestos identification, the implementation of safe removal and disposal practices, conducting public awareness campaigns, and providing support to affected communities through rehabilitation efforts. A significant amount of asbestos persists as a historical legacy from its past use in the construction of residential, public, and commercial structures (Ramazzini 2010). Proactive environmentally sound asbestos removal is essential to mitigate the ongoing risk of asbestos contamination

and exposure resulting from deteriorating, disturbed or damaged asbestos containing materials (ASEA 2023b, Khatib *et al.* 2023). This is expected to lead to health and environmental benefits by minimizing asbestos exposure and its impact (ASEA 2023b), but also to improve the long-term sustainability of construction, playing a role in sustaining limited resources overall (Khatib *et al.* 2023). The provision of government incentives is vital for accelerating the environmentally sound and proactive removal of asbestos (ASEA 2023b).

Option 4: Cultivating partnerships and improving resource mobilization, to reinforce capacity-building and advance awareness-raising efforts about the risks of asbestos. This is intended to bolster the effective management of asbestos and materials containing asbestos. Partnerships at the national level exist within the asbestos value chain, for example providing solutions for asbestos removal (Duregger 2021) and conducting research programs (Winters *et al.* 2014). Further exploration is required to enhance collaboration with industry and other key stakeholders. This is crucial for developing effective and efficient strategies related to identification, safe removal, transition to safer alternatives, and proper waste management of asbestos (Vincenten *et al.* 2017). There is a necessity to enhance the mobilization of financial resources, encompassing government grants and subsidies, fostering public-private partnerships, utilizing insurance products, accessing loans and grants from community development financial institutions, and leveraging environmental trust funds. This is crucial to facilitate the removal of asbestos and asbestos-containing materials, including from legacy use. There is a need to enhance capabilities to conduct the identification, removal, replacement and management of asbestos waste securely and cost-effectively, while concurrently launching awareness campaigns to educate consumers, local industries and vulnerable populations about the associated risks. Emphasis is to be placed on the significance of adopting environmentally sound practices.

Option 5: Enhancing the generation of comprehensive knowledge and data, strengthening early diagnosis, treatment, and rehabilitation services, and ensuring access to information concerning asbestos to support informed decision-making and actions. While a considerable amount of information and data is already accessible, certain gaps emerged in the course of preparing this summary paper, such as: a) impact of asbestos and potential effects on ecosystems and wildlife; b) remaining global uses of asbestos; c) magnitude of global asbestos contamination; d) magnitude of asbestos exposure in the aftermath of natural disasters and armed conflicts; e) difference in magnitudes of occupational exposure and environmental exposure to asbestos; f) unintentional asbestos contamination of consumer products, including their origins and pathways of contamination; g) economic factors related to the continued use of asbestos, including the cost of inaction; h) availability of safer alternatives to asbestos; i) trade-offs between minimizing or eliminating asbestos pollution in the construction sector and ensuring energy-efficient buildings within the context of a climate-neutral future; j) potential differential toxicity and carcinogenicity among different types of asbestos fibres; k) existence of systematic surveillance systems at the national level to identify and record the number of mesothelioma cases. Therefore, there is a need to step up the efforts in generating sufficient data and information to underpin informed decision-making and actions.

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