Online workshop on asbestos waste management practices and treatment technologies

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Welcome and housekeeping rules

- **We are recording this webinar.** You will be able to download the proceedings and slides from our website

- **Comments and questions are welcome**
  - **Questions and chat:** Please use the chat-box to ask written questions to the presenters
  - **Raise your hand and we will give you the floor:** All will be placed under “mute” except the designated speaker. Request permission to speak directly to the plenary via your voice connection

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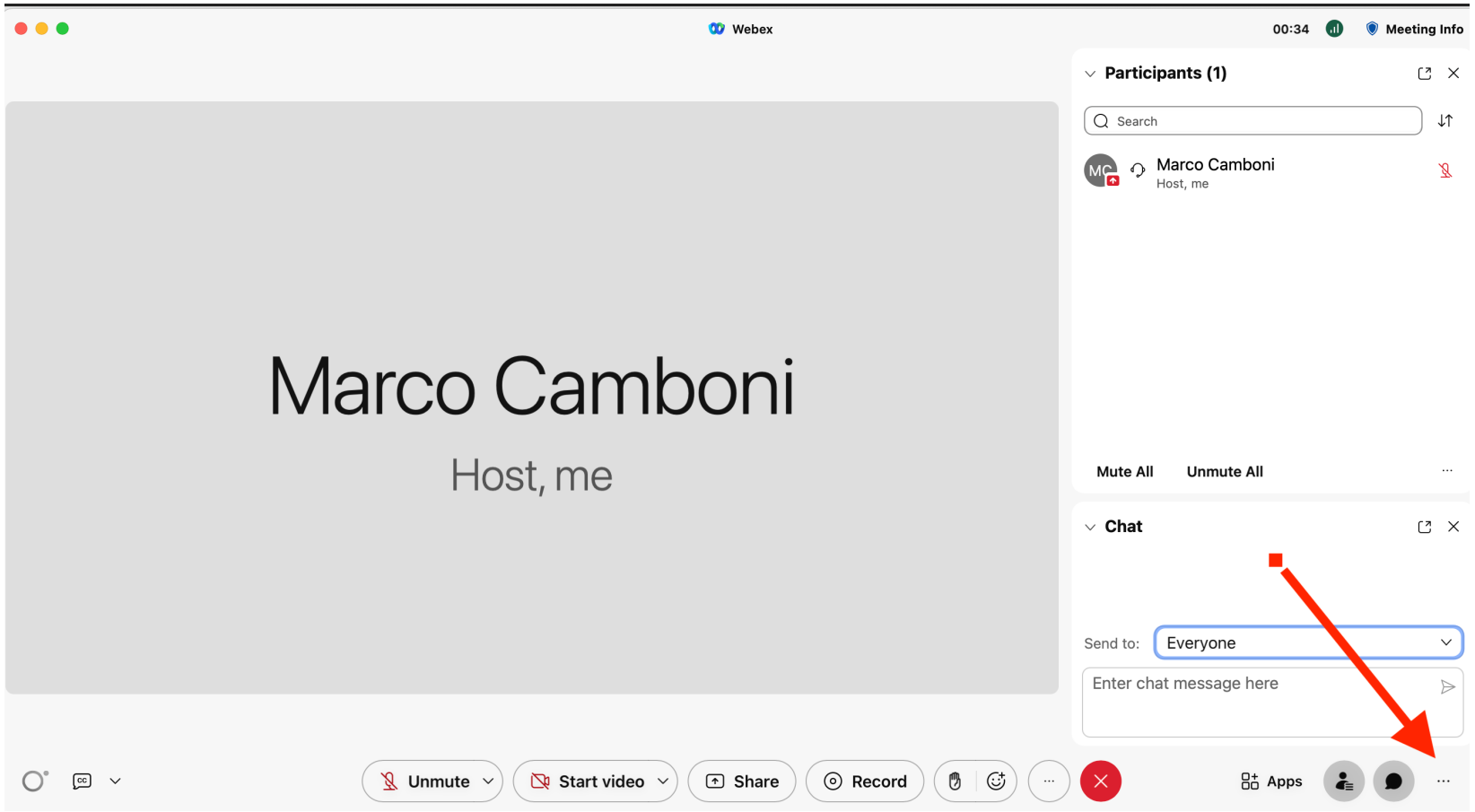
Welcome and housekeeping rules



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More panels -> Polling

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Welcome message from the Commission and introduction to the aims of the study

Enrique García John, European Commission DG Environment

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Research questions and methodology

Asbestos waste management practices and treatment technologies

Online workshop

Marco Camboni, RPA Europe

15 June 2023

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Presentation outline

- Who we are
- General and specific objectives
- Methodology
- Work progress and next steps
- Agenda

RPA Europe

Who are we?

RPA Europe is specialised in the socioeconomic assessment of environmental policies. Along with RPA Prague, we are a sister company of Risk & Policy Analysts Ltd and we have now offices in Czech Republic, Italy, Lithuania and the UK.

ARCADIS offers multidisciplinary advice, engineering services and project management, providing total solutions for projects in the field of infrastructure, transport & spatial planning, water, environment, buildings & technical installations. ARCADIS has a worldwide presence and EU offices in Belgium, France, Germany, Ireland, Italy, the Netherlands, Poland, Portugal, Romania and Spain.

DTI develops, applies, and disseminates research- and technology-based knowledge and has extensive experience in sustainability within the built environment, characterisation and management of construction and demolition waste, identification, sampling, detection and remediation of hazardous substances in buildings, pre-demolition audits, selective demolition, circular economy and LCA. DTI has 35 specialist centres and offices in Denmark, Sweden, Norway, Poland, and Spain.

Objectives of the current study

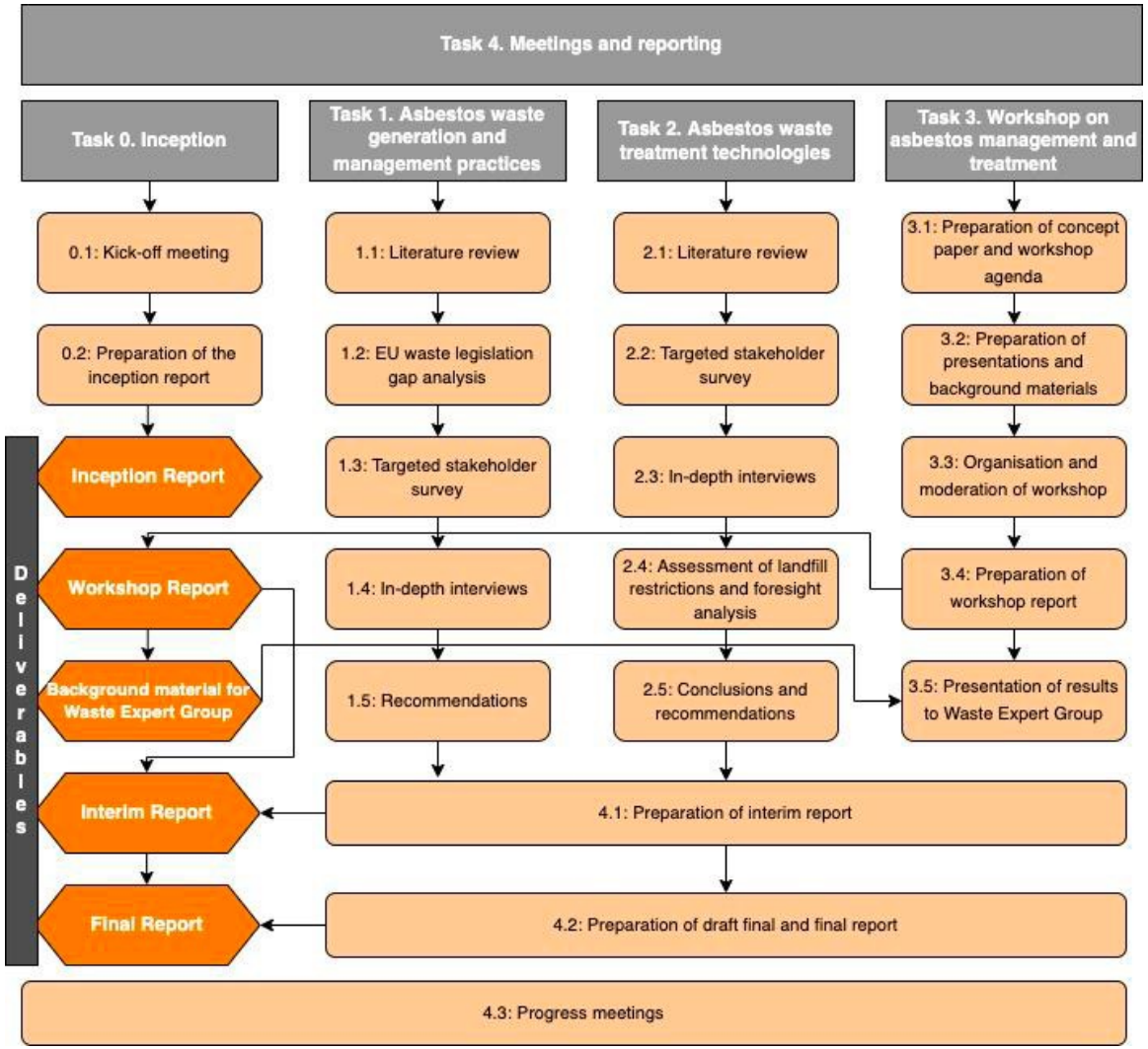
General objective

- To investigate asbestos waste management **practices and technologies** in Europe and beyond

Specific objectives

- To identify the **main sources** of asbestos waste and the **places** of buildings and infrastructures **where asbestos is commonly found**;
- To collect EU and national quantitative **data on amounts of asbestos waste generated, collected and treated**;
- To **map installations collecting and treating** asbestos waste and gather information on **capacities and costs**;
- To identify and rank asbestos waste **treatment technologies** and collect information on their **economic and sustainability profiles**, **current and potential capacities, barriers and opportunities**;
- To assess how asbestos waste generation, collection and treatment may evolve in **future**;
- To identify asbestos waste management **best practices and propose measures** to improve asbestos waste management;
- To search for any **legislative gaps and provide recommendations** on how to address the identified issues.

Overview of tasks and deliverables



Research tools:

- Literature review
- Expert surveys
- Semi-structured interviews
- Workshop

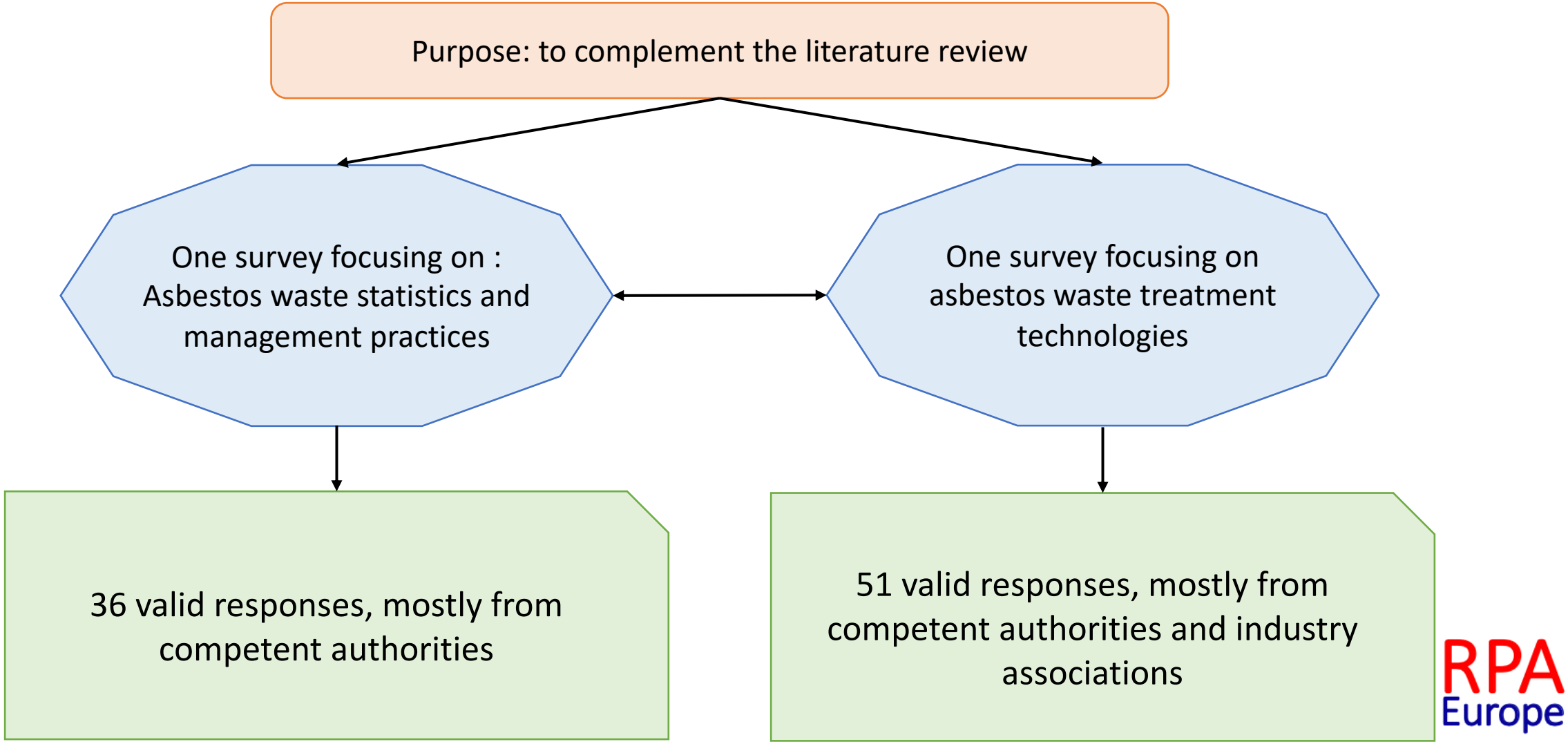
Conclusions and recommendations on:

- Data (data gaps and/or inconsistencies)
- Legislation (legislative gaps)
- Best practices
- Treatment technologies

Literature review

- From 2018 to date
- 51 peer-reviewed publications
- 10 EU research projects
- 44 patents
- 11 other sources

Expert surveys



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Work progress and next steps

- Submitted the interim report on **2 June 2023**
- Between **June and July** we will carry out a number of interviews to fill in information gaps and validate the data gathered
- Draft final report expected by end of **September 2023**
- Final report by end of **October 2023**

Agenda

Introduction to the study and preliminary findings	
09:00 – 09:30	Registration
09:30 – 09:35	Welcome and housekeeping rules (Marco Camboni, RPA Europe)
09:35 – 09:40	Welcome message from the Commission and introduction to the aims of the study (Enrique García John, DG Environment)
09:40 – 09:50	Research questions and study methodology (Marco Camboni, RPA Europe)
09:50 – 10:05	Quantities and sources of asbestos waste (Francesca Chiabrando, RPA Europe)
10:05 – 10:20	Asbestos waste management legislation and practices in the EU (Daniel Vencovsky, RPA Prague)
10:20 – 10:35	Current and emerging asbestos waste treatment technologies (Rūta Akelytė, RPA Europe)
10:35 – 10:50	Q&A
10:50 – 11:00	Break

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Agenda

Topic-specific sessions and wrap-up	
11:00 – 12:30	**Morning session: Management of asbestos waste in the EU: policies and practices** What are the key elements of a national asbestos management strategy? What are the key challenges to be solved? Is there a need for EU action? What are the asbestos waste management best practices? *Moderated by Daniel Vencovsky – RPA Prague* *Keynote speakers:* *Stefania Butera – Danish Technological Institute* *Olaf Dünger – ARCADIS*
12:30 – 13:30	Lunch break

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Agenda

13:30 – 15:00	**Afternoon session: Current and emerging technologies for the treatment of asbestos waste** What are the key characteristics of the most promising technologies? What are the main technical and market barriers? What are the products that can be obtained and what are their safety profiles, potential uses and market opportunities? *Moderated by Zinaida Manžuch – RPA Europe* *Keynote speakers:* *Nicolas Humez – Chairman of Hazardous Waste Europe* *Jos Hofs – Chief Financial Officer at Asbeter Holding B.V.*
15:00 – 15:30	Break
15:30 – 16:00	Presentation of discussion outcomes and wrap-up

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Thank you!

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Quantities and sources of asbestos waste

Asbestos waste management practices and treatment technologies

Online workshop

Francesca Chiabrando

15 June 2023

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Presentation outline

- Asbestos waste statistics at EU level
- Asbestos waste statistics in Member States – preliminary findings
- Shortcomings
- Lessons learned

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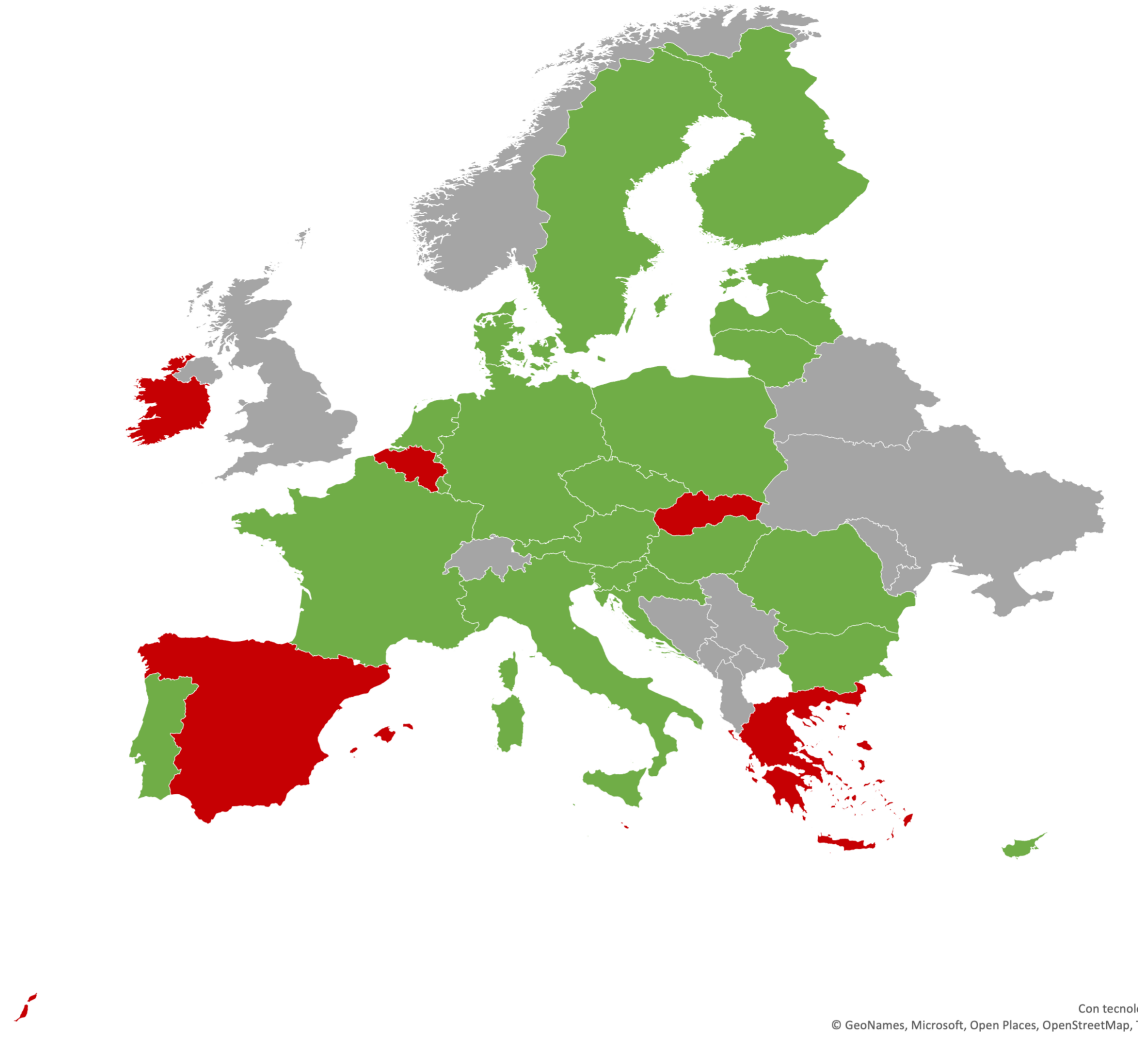
Asbestos waste statistics in the EU

Statistics on asbestos waste are **not available at the EU-level**

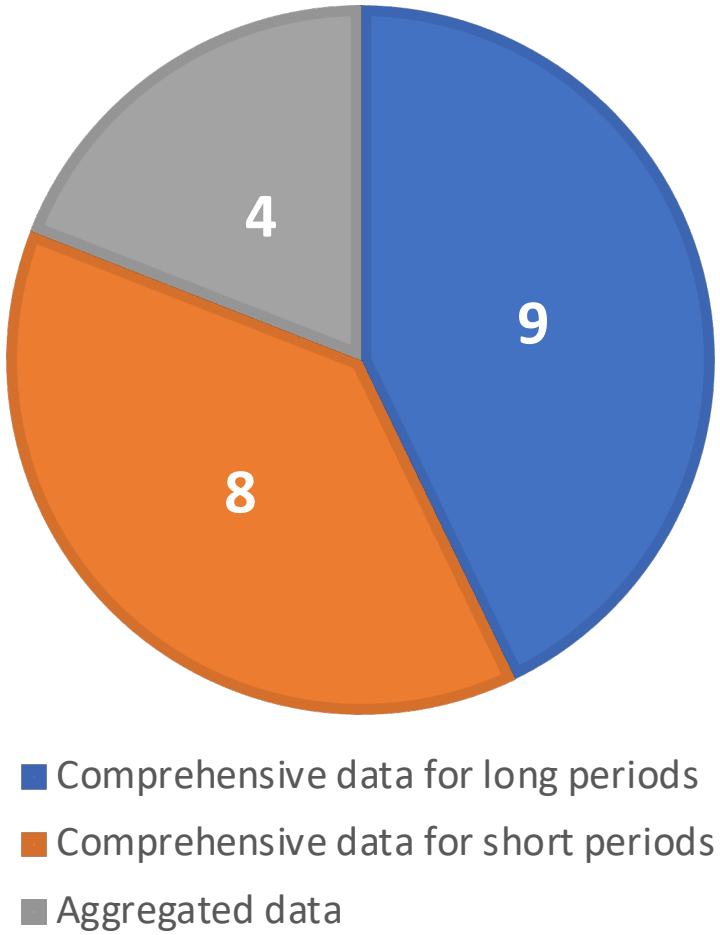
Data is published at national level, but it **differs among Member States**

Asbestos waste statistics in Member States

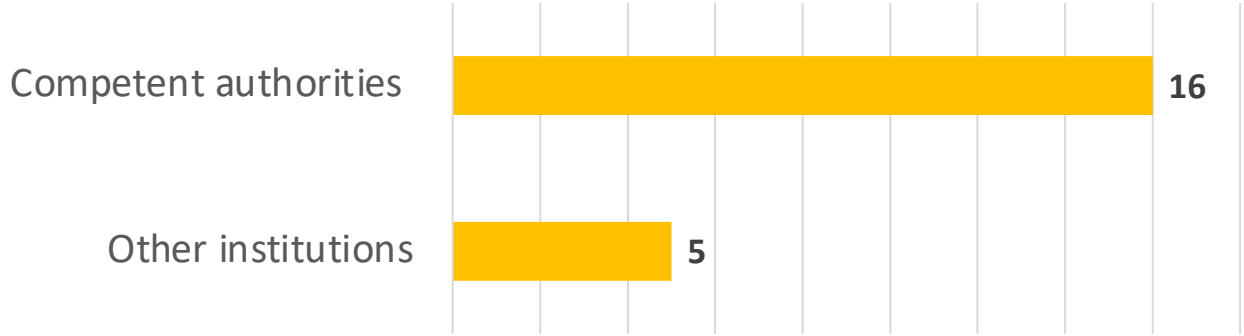
- Publicly available databases found for 21 Member States
- Interviews will be carried out to fill in the gaps



Asbestos waste quantities in Member States



- **Comprehensive data**: Asbestos waste is categorised according to the European LoW codes or other classification systems
- **Aggregated data**: only aggregated data for all asbestos-containing waste is available



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Examples of List of Waste codes used in Member States

Lithuania, Germany, Italy, …

European List of Waste codes

06 07 01	Wastes containing asbestos from electrolysis
06 13 04	Wastes from asbestos processing
10 13 09	Wastes from asbestos-cement manufacture containing asbestos
15 01 11	Metalling packaging containing asbestos
16 01 11	Brake pads containing asbestos
16 02 12	Discarded Equipment containing free asbestos
17 06 01	Insulation material containing asbestos
17 06 05	Construction materials containing asbestos

Austria

ÖNORM S 2100 codes

31412	Asbestos cement
31413	Asbestos cement dust
31437	Asbestos waste, asbestos dust
31609	Asbestos cement slurry
57503	Rubber asbestos

Poland

Product codes

W01	Flat asbestos-cement plates used in construction
W02	Corrugated asbestos-cement sheets for construction
W03.1	Asbestos-cement pipes and joints for removal
W03.2	Asbestos-cement pipes and joints to be left in the ground
W04	Spray insulations with asbestos-containing agents
W05	Asbestos-rubber friction products
W06	Special yarns, including processed asbestos fibres (protective fabrics and clothing)
W07	Asbestos sealants
W08	Woven and braided tapes, cords and strings
W09	Asbestos and rubber products, except friction products
W10	Paper, cardboard
W11.1	Asbestos-cement covers
W11.2	Asbestos-cement construction fittings (ventilation ducts, windowsills, flue gas covers)
W11.3	Asbestos-cement electrical insulating fittings
W11.4	PVC tiles
W11.5	Fireproof boards
W11.6	Roofing felt, putties and waterproofing compounds
W11.7	Household appliances
W11.8	Work clothes, masks, filters contaminated with asbestos
W11.9	Other not mentioned above
W12.1	Secured roads
W12.2	Unsecured roads

Asbestos waste quantities in Member States

Common elements

- Use of the European LoW codes
- Long periods of time covered (around 10 years)

Differences

- Data collection methods (entities responsible for declaring the data, etc.)
- Data publication (Excel databases, annual reports, etc.)
- Inclusion/exclusion of certain information (pre-treatment info, type of landfill, etc)

Focus on 9 countries:

Croatia, Czech Republic, Denmark, Germany, Hungary, Italy, Lithuania, Luxembourg, Slovenia

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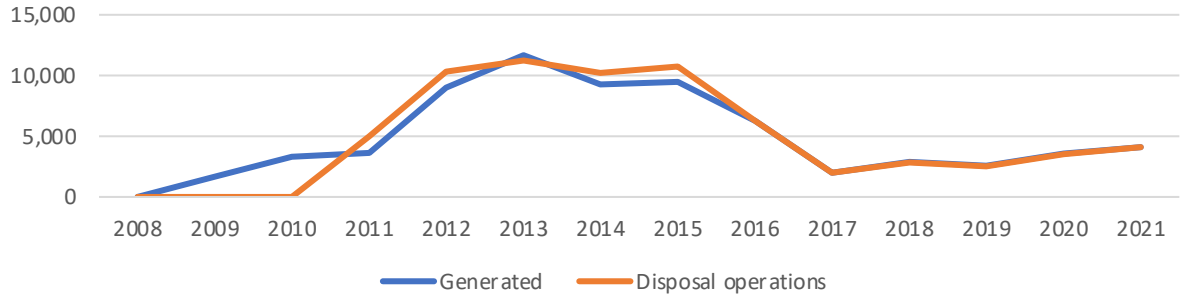
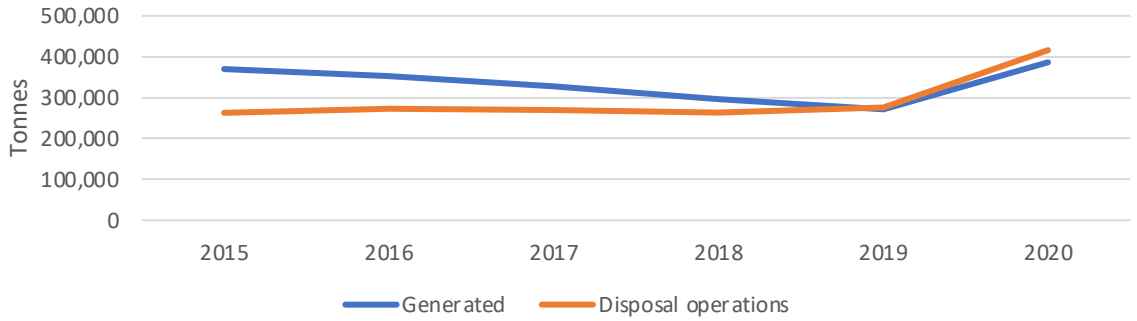
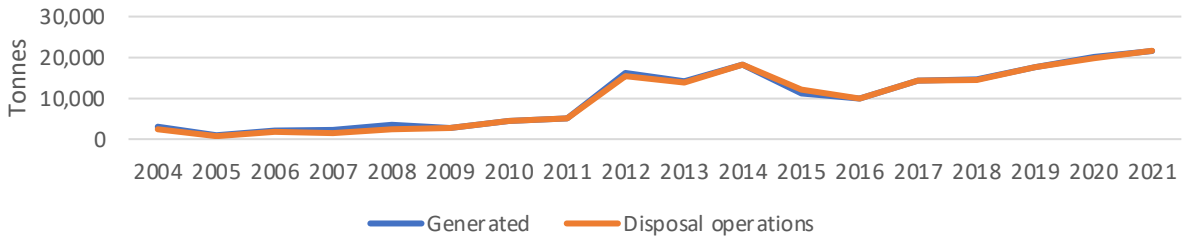
Croatia



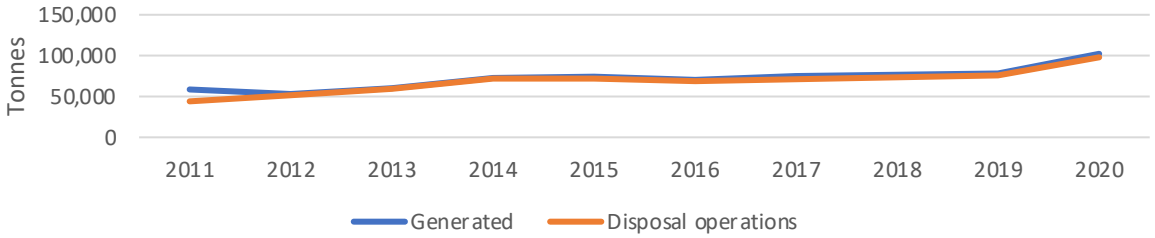
Italy



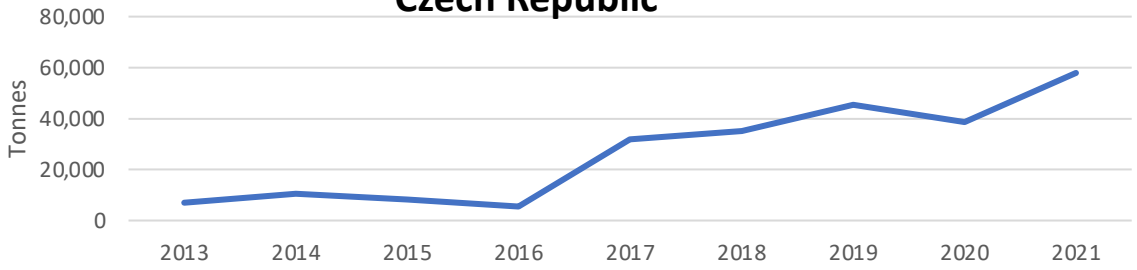
Lithuania



Denmark



Czech Republic



Several MSs registered an **increase in the last years**

Fluctuations in each MS can be caused by different reasons

- Waste collection programs/subsidies (e.g. HR)
- Programs/subsidies for the renovation of buildings (e.g. IT)

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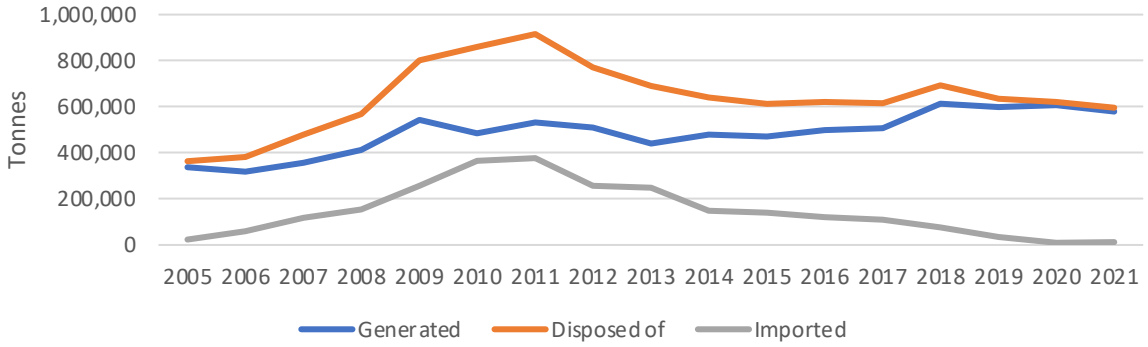
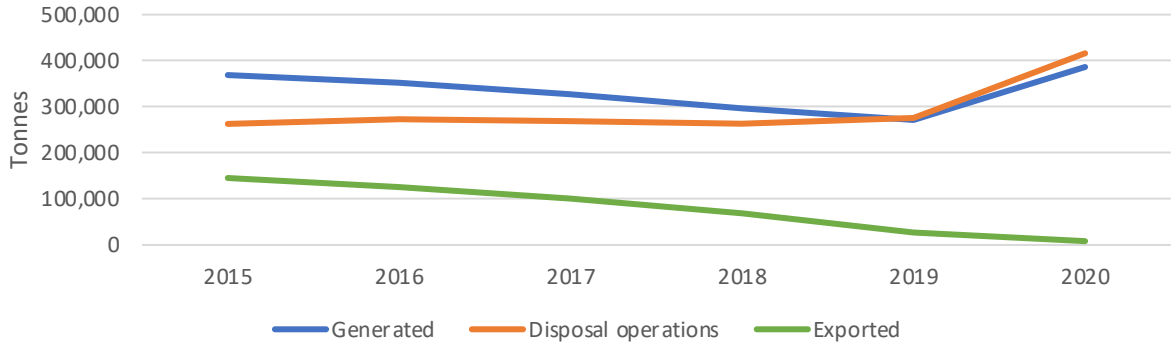
Germany

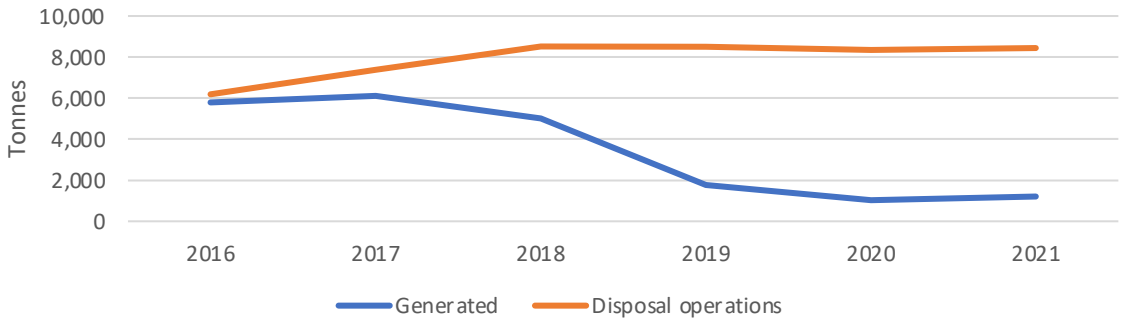


Italy

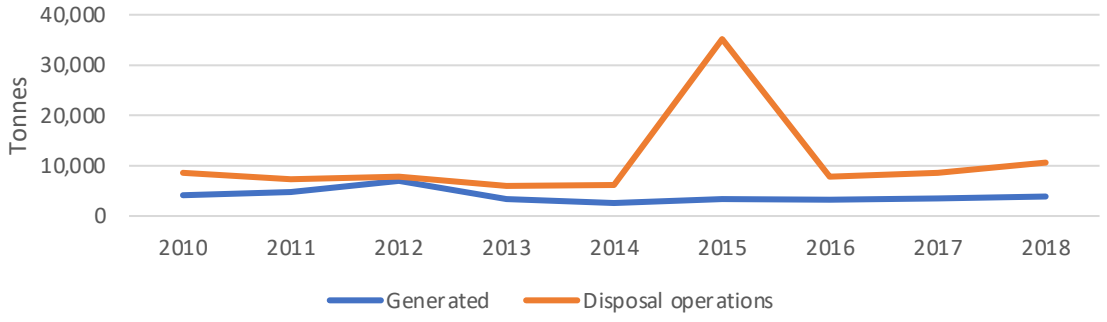


- Imports and exports can have a big impact on the quantities of waste disposed of in a MS

Slovenia



Hungary



- In other MS discrepancies between waste generated and disposed of can be caused by other factors (e.g. storage)

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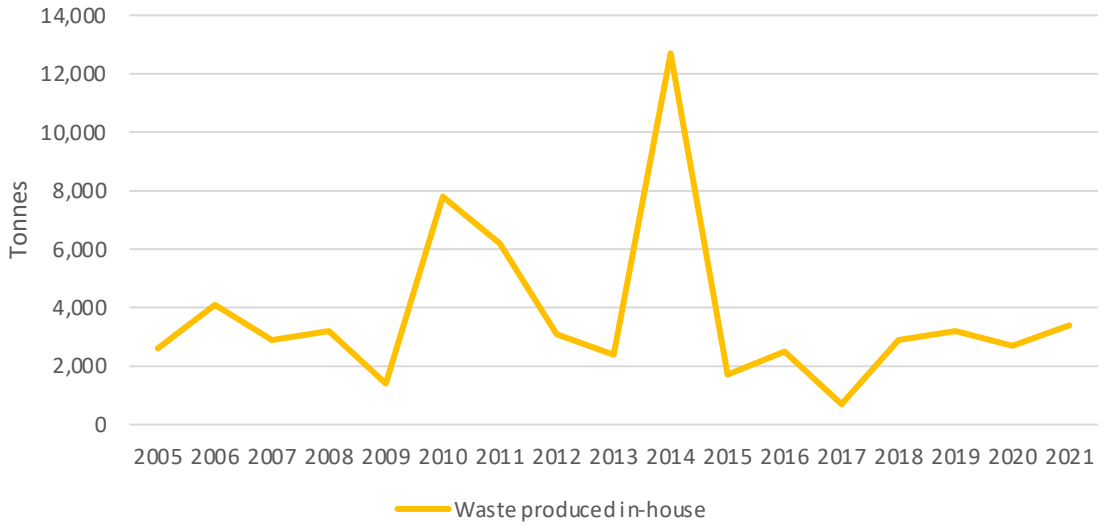
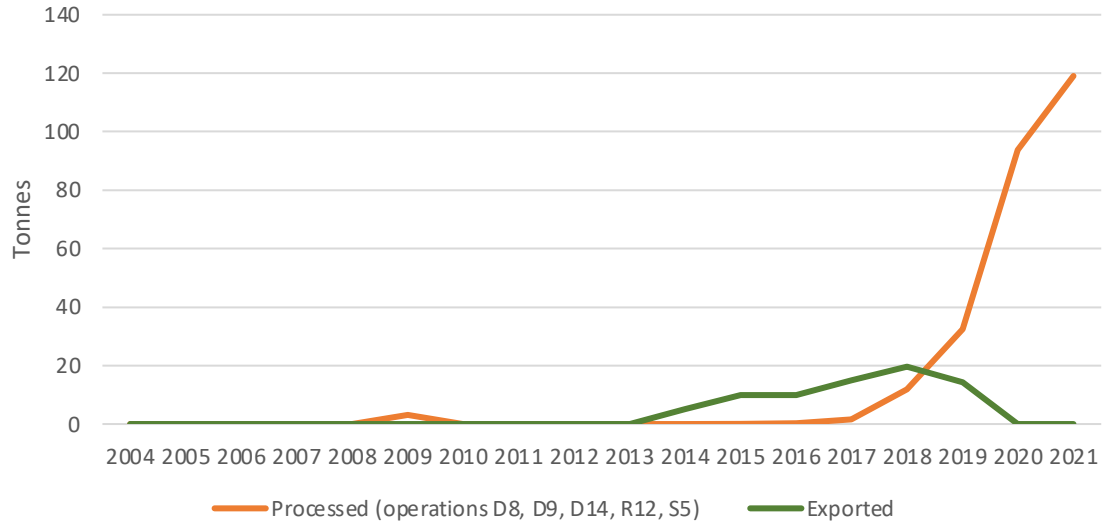
Germany

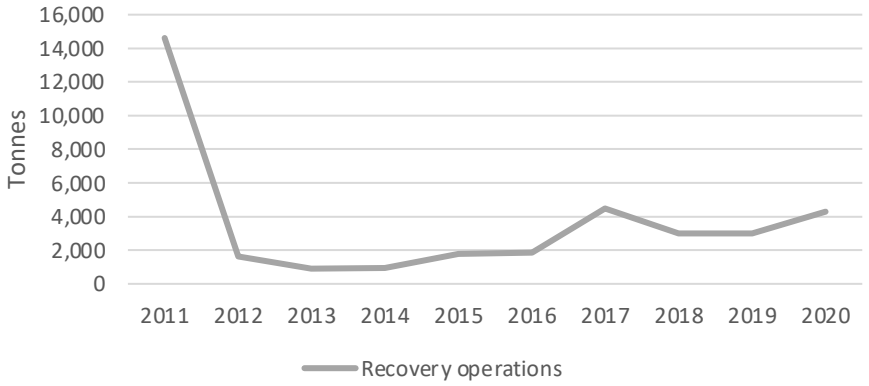


Lithuania

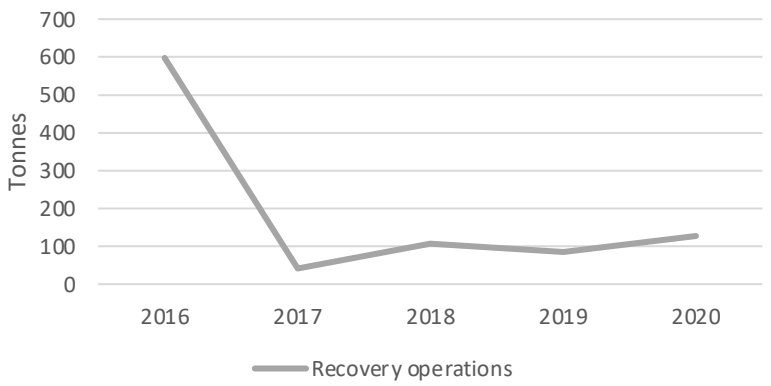


- Some MSs record additional data such as waste produced in-house or processed waste

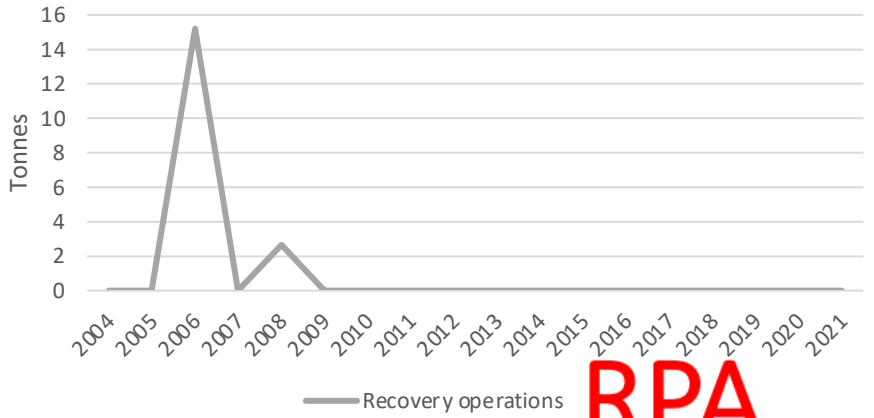
Denmark



Luxembourg



Lithuania



- Asbestos waste recorded as recycled or incinerated: recording error?

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Asbestos waste data collection - shortcomings

Data is not comprehensive

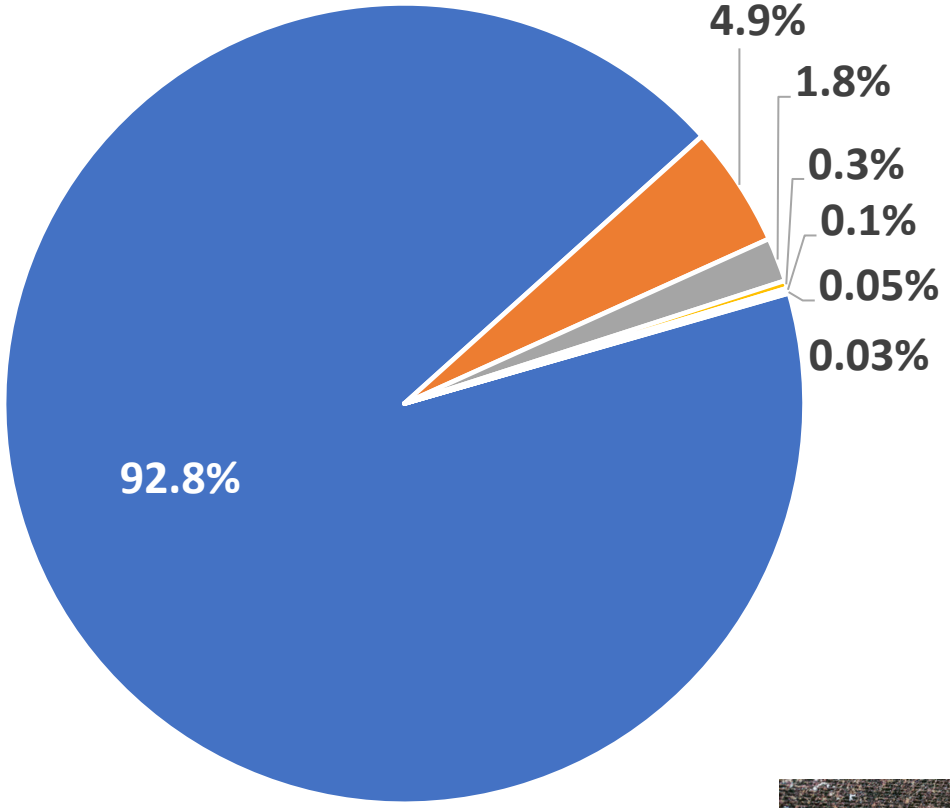
Data does not cover sufficiently long periods of time

There is no unified and standardised way of collecting data across all Member States

Recording errors

Asbestos waste by LoW codes

- 17 06 05 Construction materials containing asbestos
- 17 06 01 Insulation materials containing asbestos
- 15 01 11 Metallic packaging containing a dangerous solid porous matrix (e.g. asbestos), including empty pressure containers
- 16 02 12 Discarded equipment containing free asbestos
- 10 13 09 Wastes from asbestos-cement manufacture containing asbestos
- 16 01 11 Brake pads containing asbestos
- 06 13 04 Wastes from asbestos processing



Lessons learned

No trend or pattern common to all MSs analysed, but we can see increase in waste disposed of in the last 5-6 years in many MSs

Different subsidies/programs in place in the MSs affect the quantities of waste generated and disposed of

Asbestos waste data is reported differently in MSs and quantities registered depend on various factors (how data is collected, which information is included/excluded, ...)

The lack of a standardised process MSs should follow to collect and report data makes it difficult to compare and establish useful trends

Thank you!

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Practices for the management of Asbestos Containing Waste (ACW) in the EU

Workshop 'Asbestos waste management practices and treatment technologies'

Daniel Vencovsky

15 June 2023

RPA | PRG

Relevance

- Why are we considering ACW management practices?
- We are trying to identify:
  - Context for the study
  - Best practices in ACW management
  - Gaps in ACW management that prevent circularity, affect safety or leave a negative legacy for future generations
  - Obstacles to the feasibility of potential waste management targets
  - Gaps in EU waste legislation and potential solutions

Scope

- ACW = primarily CDW
- All EU Member States but better information for some
- Primarily national but, in some countries, competences at the state, regional or local level
- Legislation, guidance, common practice
- ACW management:
  - Identification of ACW
  - Removal, collection, separation, handling
  - Treatment and disposal

National guidance documents

- Approx. 50% EU Member States have guidance document(s) that provide information on ACW handling and disposal
- In the other 50%, no guidance document(s) was identified or consultees confirmed no such document(s) existed

Number of Member States with/without guidance documents		
	Yes	No
Guidance with relevance to ACW management	14 (50%)	13 (50%)
Guidance with high relevance to ACW management	10 (40%)	17 (60%)

- In some Member States, although guidance documents exist, they primarily focus on occupational exposure to asbestos and contain limited information on the treatment or disposal of ACW.

ACW identification (1/2)

- Screening for ACM in buildings
  - European Commission's 2018 Waste Audit Guidelines: "Materials containing asbestos should be specifically considered"
  - The practical implementation of Pre-Demolition Audits (PDAs) is decided at national level
- Asbestos screening in EU Member States
  - In 70% of Member States, mandatory asbestos screening; in 20% not mandatory; no information for the remaining 10%
  - Differences in terms of what triggers the application of the screening requirement, for example a) demolition or renovation where asbestos exposure is likely to occur, b) any demolition or renovation, c) change of ownership of the building or d) a requirement that all buildings must be screened by a certain date

OPINIONS ON GOOD PRACTICE FROM CONSULTATION:

- "**Maximising separation** of asbestos waste from non-asbestos-containing waste through selective collection and by using techniques that minimise the mixing of asbestos fibres with non-asbestos-containing or recyclable material."
- "The classification of asbestos waste as **hazardous waste** guarantee the safe treatment, registration and traceability until final treatment (landfilling). In the case of household waste that contains asbestos, it is important to facilitate its delivery to municipal facilities that guarantee its safe management."

ACW identification (2/2)

- Approaches to asbestos surveys vary
- Visible and non-visible asbestos containing products
- Methods of identifying whether asbestos is present (invasive, non-invasive, both, etc.).
- Sometimes depends on the context/both can be used, e.g. in Flanders, non-destructive when selling or by 2032, but in cases of demolition and renovation, there is always a destructive inspection.

OPINIONS ON GOOD PRACTICE FROM CONSULTATION:

- 'For example, in Flanders mandatory screening by **private owners of buildings whenever a building is sold, and all buildings must be screened by 2032** even where there is no change in ownership. The results of asbestos surveys are centrally collated by OVAM (Public Waste Agency of Flanders). In addition, there is a requirement for asbestos screening and removal from public buildings.

Removal, collection, separation

- Member States typically have in place requirements to ensure removal of asbestos prior to demolition and/or separation of ACW from other CDW (for example, Austria, Czech Republic, Denmark, Estonia, etc.)
- Member States also typically have in place licencing and permit systems for asbestos removal operators and activities.
- Member States also typically have in place requirements on collection and transport of ACW in closable containers/packaging.
- Advice on removal, separation, collection activities is provided in many of the national guidance documents (but extent and detail varies).

OPINIONS ON GOOD PRACTICE FROM CONSULTATION:

- Measures to **prevent environmental emissions and occupational exposure**
- "For **households** specially designed containers which are in use at municipal civic amenity sites. The are normally locked and only opened by the personal on demand to hinder the contamination of asbestos."
- "Implementation of **selective collection** and recycling of asbestos-free fibrocement (still landfilled together with asbestos containing fibrocement)"

Treatment and disposal

- Main treatment/disposal option is landfilling, although the rules on which types of landfills ACW can be disposed of in, pre-treatment requirements and the specific landfilling practices vary.
- Many Member States do not allow or advise against recycling and/or preparation for reuse of ACW.
- Incineration is often allowed but not practiced for practical reasons.
- Possible export from some countries.

OPINIONS ON GOOD PRACTICE FROM CONSULTATION:

- "**Landfilling** is the best option **to isolate asbestos** fibres from the biosphere and to secure human health risk linked to asbestos waste. "
- "Ensure the complete isolation of the asbestos fibres from the environment and material loops. […] On these kinds of waste, the main concern should be the **protection of health and the environment before any circular economy thoughts**."
- "**Recycling hazardous waste into non-hazardous waste** and, if possible, into other products that have value and are not harmful to the environment."
- "The best practices are, per our opinion, **neutralization and recycling**."
- Specific best practices for landfilling: compacting, special sectors (e.g. to avoid the mixing ACW and biowaste), packed in sealed containers, covered before compacting, etc.

Thank you

Current and emerging asbestos waste treatment technologies in the EU

Asbestos waste management practices and treatment technologies

Online workshop

Rūta Akelytė

15 June 2023

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Presentation outline

- Overview of study findings
- Existing asbestos waste treatment technology
- Emerging asbestos waste treatment technologies
- Next steps

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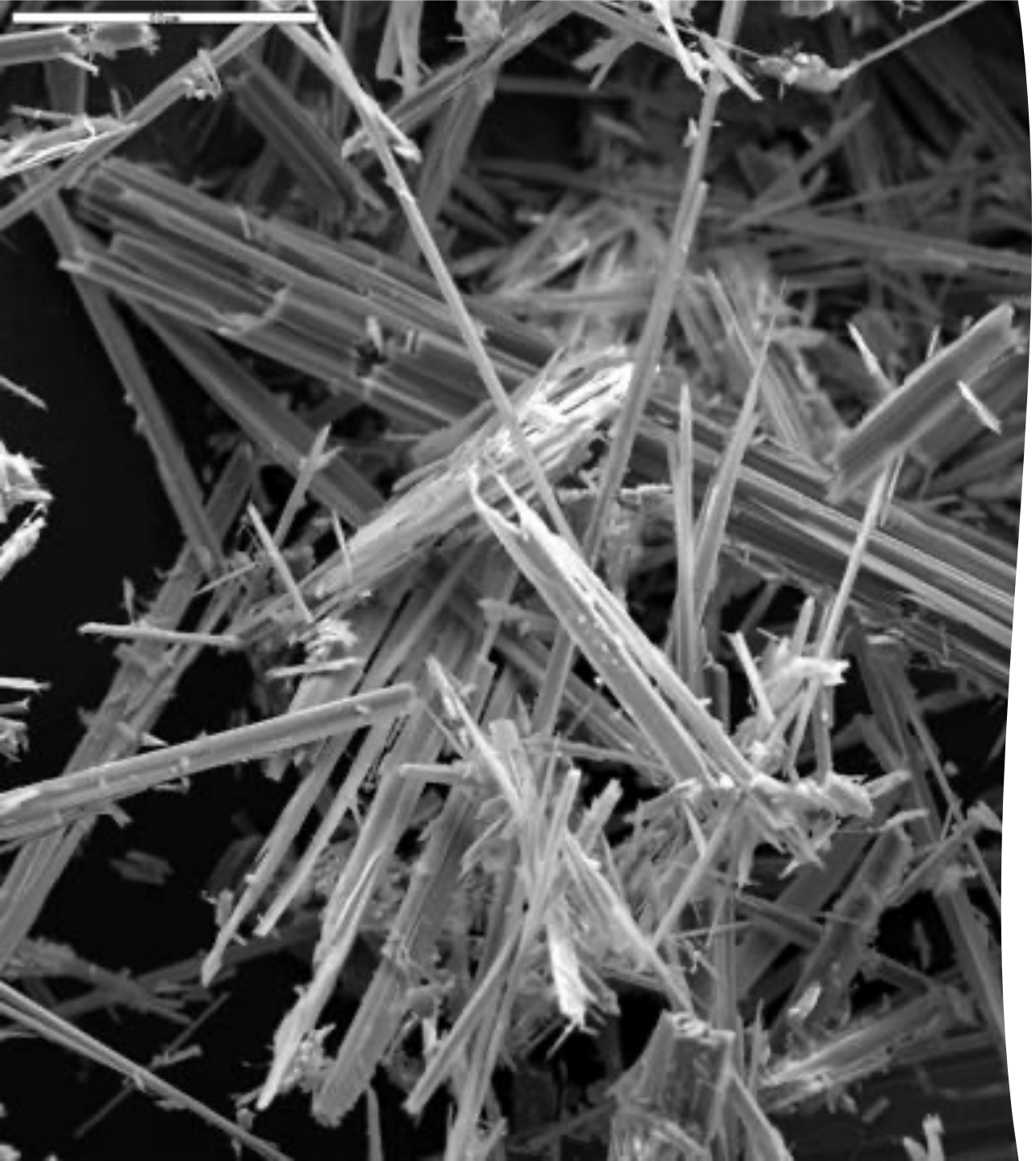

Overview of study findings

- The most common technology: **thermal treatment**
- The majority of treatment methods have been performed in a laboratory
- Only one plant treating asbestos waste on **industrial scale in Europe**: Inertam plant in France that uses thermal plasma vitrification technology
- Several technologies moved from laboratory setting to **pilot or demonstrator plant**

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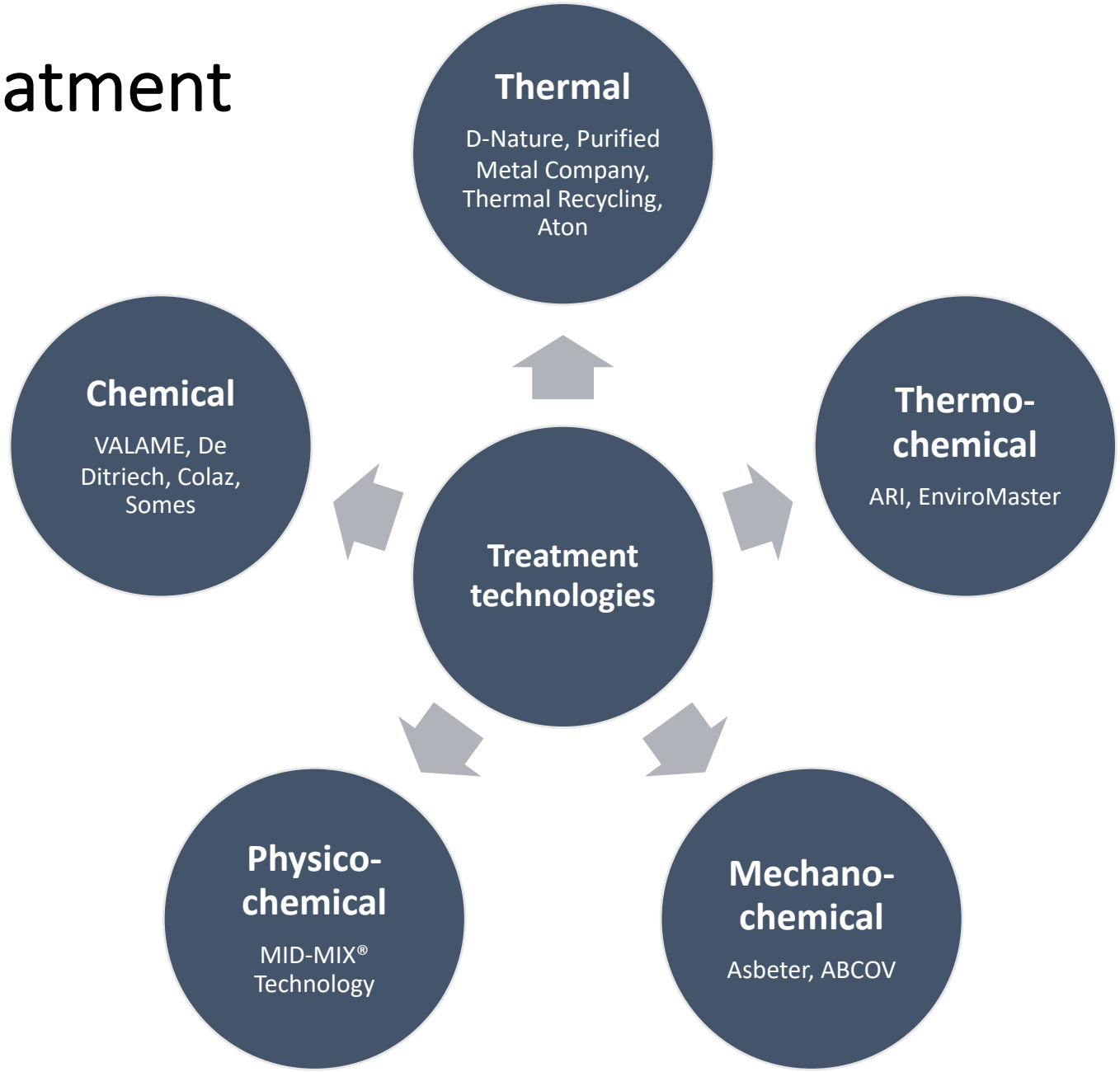
Existing asbestos waste treatment technology

- Thermal plasma vitrification of asbestos-containing waste at Inertam plant in France designed by Europlasma
- Transforms asbestos waste into a **road construction material 'cofalit'** on an industrial scale
- Operates at temperature ~1,600°C
- Licensed to treat 8,000 t/year at 1,000-2,500 €/t
- Advantages:
  - Complete destruction of asbestos fibres
  - Low emissions of gases
  - Transformed asbestos waste can be reused as a construction material
- Disadvantages:
  - Installation and operational costs are high
  - Process requires a lot of energy

Cofalit. Source: Inertam website

Emerging treatment technologies



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Thermal treatment

- Principle: melting of asbestos-containing waste
- Temperatures: 650 – 1,600°C (depending on technique)
- Techniques: vitrification, ceramitisation, denaturation
- Outcome: secondary material

Advantages

- Flexibility to treat wastes of various types
- Harmless secondary materials that are recyclable
- Consolidated technology
- Existing full-scale facilities

Disadvantages

- High energy demand due to high temperature
- High cost
- Expensive equipment
- Formation of atmospheric pollutants
- Extreme temperatures and high corrosion

Company/project	Waste stream	Outcome/by-product	Treatment capacity	Cost
D-Nature (NL)	Asbestos cement waste	'Bestof'	100,000 t/year	175 €/t
Purified Metal Company (NL)	Scrap contaminated with asbestos fibres	Purified Metal Blocks (PMBs)	100,000 t/year	100 €/t
Aton (PL)	Asbestos-containing waste	Neutralised asbestos waste, road substrate	Unknown	Unknown
Thermal Recycling (UK)	Chrysotile in asbestos waste from roofs	Aggregate for road building	EA permit to treat 29,500 t/year	Unknown

Chemical treatment

- Principle: dissolution of asbestos-containing waste in acid/base
- Temperatures: room – 200°C
- Chemicals used: hydrofluoric, hydrochloric, sulphuric acids, sodium, potassium hydroxides
- Outcome: secondary material

Advantages

- Low energy consumption (process at low temperature)
- Complete destruction of asbestos fiber
- Products can be recycled as secondary materials
- Transportable installations

Disadvantages

- Costs of reagents
- Long treatment time
- Potentially highly corrosive conditions
- Inherent risk from working with strong chemicals
- Need for treatment of liquid waste

Company/project	Waste stream	Outcome/by-product	Treatment capacity	Cost
VALAME (FR)	Asbestos waste containing chrysotile	Calcium & magnesium chlorides, amorphous silica	Fixed units: 15,000 t/year	900 €/t - fixed units
Black Asbestos/De Dietrich (FR)	All types of asbestos waste	Silicon, anhydrite, magnesium	Pilot: 25 t/year Fixed units: ~15,000 t/year	500 to 800 €/t - fixed units
Somez (FR)	All types of asbestos waste	Silica, metal oxides, tobermorite	Semi-industrial pilot plant: 30 t/year Fixed units: 10 to 20,000 t/year	600 to 800 €/t –fixed units
Colas (FR)	Favours treatment of asbestos-cement	Amorphous silica, hydroxyapatites, metals	Tens of thousands of t/year envisaged	Aiming for a lower destruction cost than plasma technology

Thermochemical treatment

- Principle: shredding and mixing asbestos-containing waste with fluxing agent and then heating for demineralisation
- Temperatures: 1,200-1,250°C
- Duration: ~20 min
- Outcome: secondary material

Advantages

- More rapid process
- Lower energy input
- High volume reduction
- Products can be recycled as secondary materials

Disadvantages

- High operational pressure
- Costs of reducing agents
- Still requires a lot of energy leading to high costs

Company/project	Waste stream	Outcome/by-product	Treatment capacity	Cost
ARI/EnviroMaster (UK, US, AU)	All types of asbestos in all types of asbestos-containing waste	Inert aggregate in non-structural construction applications	100 t/day	300 to 400 €/t depending on the capacity

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Mechanochemical treatment

- Principle: chemical and physical-chemical transformations produced by the effect of mechanical energy
- Use of chemicals: with or without addition of acids/bases
- Outcome: secondary material

Advantages

- Can be done at fixed or mobile units
- Does not require thermal equipment
- Economic process
- Limited or no dust and gas pollution

Disadvantages

- Equipment to deal with dust is usually required

Company/project	Waste stream	Outcome/by-product	Treatment capacity	Cost
Asbeter (NL)*	Asbestos cement	Calcium silicate hydrates	75,000 tons/year	400 €/t
ABCOV (US)	All types of asbestos	Recyclable non-asbestos product	Unknown	Unknown

* The company is using wet process where no chemicals to create alkaline environment are added; mechanical part creates the environment for the chemical step in which fibres are dissolved. The process can only be done at fixed units.

Physicochemical treatment

- Principle: homogenisation of pre-treated asbestos-containing waste in a mixer with process additives and solidification in a reactor
- Outcome: secondary material

Advantages	Disadvantages
• Obtained material is used as a resource • No pollution to environment • Plants can be mobile and stationary • Existing full-scale facilities	• High cost • Health risk if not treated adequately • Only applicable to asbestos dust and sludge

Company/project	Waste stream	Outcome/by-product	Treatment capacity	Cost
MID-MIX® Technology (NL, RS)	Sludge containing asbestos	Material called 'Neutral'	Unknown	Unknown

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Next steps

- Comparative analysis of technologies
- Life cycle assessment (LCA) and techno-economic assessment (TEA)
- LCA – evaluates the environmental footprint
- TEA – economic viability of the technologies

Aspect	Indicators/assessment method
Technological Readiness	Technology Readiness Level (TRL) of the relevant technology
TRL timeline	Estimated TRL timeline
Current capacity	Tonnes/year per site No of sites in the EU Tonnes/year per region/Member State
Potential future capacity	Tonnes/year per site Potential number of sites in the EU Tonnes/year
Cost of treatment	Total treatment cost (€/tonne)
Amounts left for disposal after treatment and the associated cost	% waste entering treatment that needs to be disposed of after treatment (by weight) Method and cost of disposal of this waste (€/tonne)
Resale of treatment product and by-products	Description of the product and its main applications Sales price (€/tonne) Total demand for that product
Transport intensity	Average distance travelled to treatment site
Energy intensity	Average energy required/tonne
Total carbon footprint	Total carbon footprint per tonne (taking into account transport and energy intensity)
Broader pollution impacts	Emissions of asbestos Emissions of other hazardous substances
Occupational risk	Risk to workers/cost of RMMs/PPE
Other advantages/disadvantages	

Thank you!

RPA Europe

Q&A

RPA Europe

Break

Back at 11am

RPA Europe

Management of asbestos waste in the EU: policies and practices

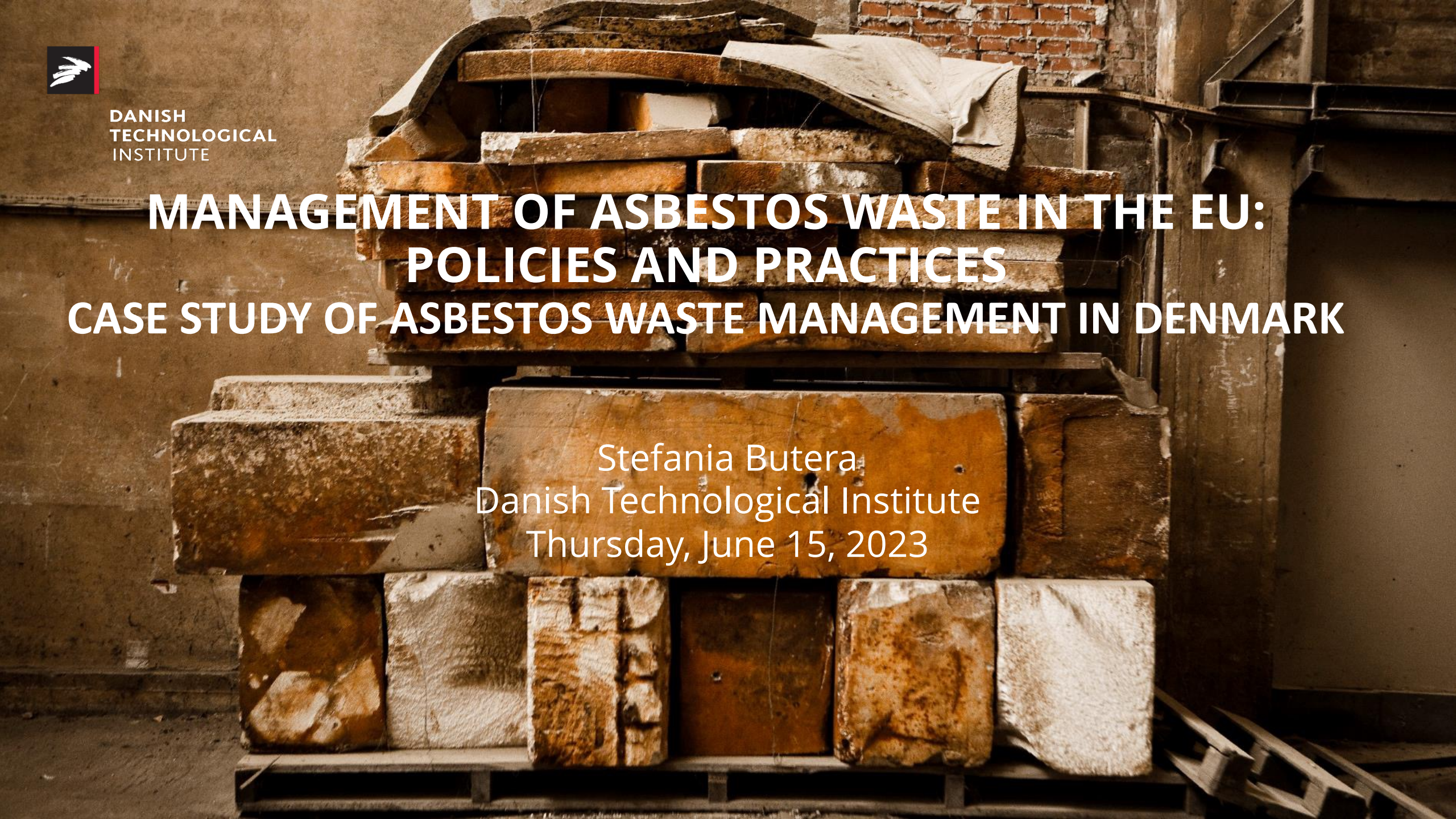
Discussion session

15 June 2023

Daniel Vencovsky (RPA Prague)

Stefania Butera (Danish Technological Institute)

RPA Europe



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MANAGEMENT OF ASBESTOS WASTE IN THE EU: POLICIES AND PRACTICES

CASE STUDY OF ASBESTOS WASTE MANAGEMENT IN DENMARK

Stefania Butera
Danish Technological Institute
Thursday, June 15, 2023

AGENDA

Amounts and sources

Classification

Requirements before demolition

Management of AWC

Challenges

DTI

- CDW management
- Pre-Demolition audits (PDA)
- Consultancy for e.g. Municipalities on waste management
- Consultancy and research projects on selective demolition, hazardous substances in CDW, circular economy in the building sector, sustainability of buildings and building materials
- Sustainability assessment (LCA, LCC, sLCA)

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BACKGROUND FOR ACW

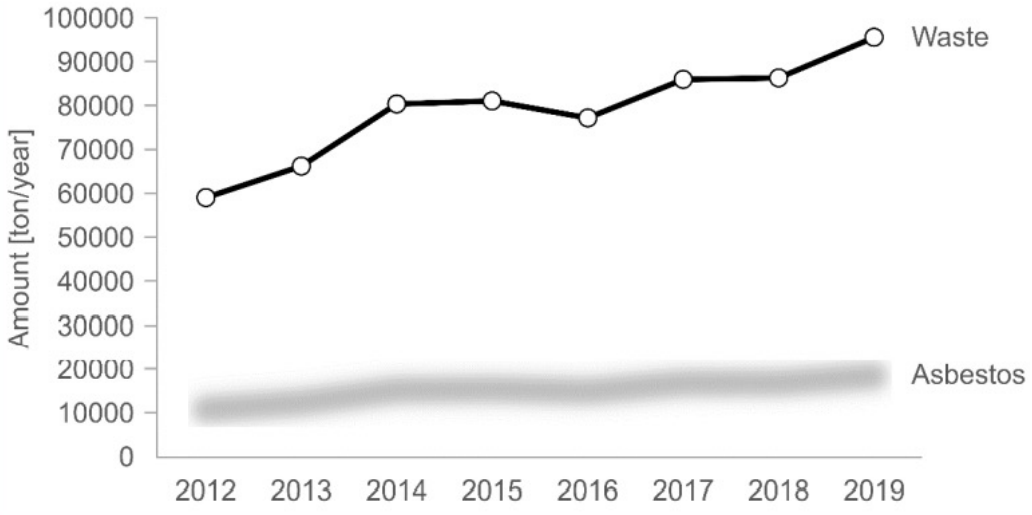

Figure retrieved from Boldrin, A., Maresca, A., Fauser, P., Sanderson, H., & Astrup, T. F. (2022). Waste containing asbestos and other environmentally problematic substances Characterization, risks and management. Danish EPA, Environmental Project no. 2216. https://www2.mst.dk/Udgiv/publications/2022/11/978-87-7038-454-4.pdf

- ACW primarily from C&D sector (98 %)
- Increasing amounts during the last decade
- Between ~ 60,000 - 90,000 t/year
- Currently ~ 90,000 t/year
- Estimated asbestos amounts ~ 10,000 - 20,000 t/year

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CLASSIFICATION OF ACW

Photo: Renosyd

- Non-dusty asbestos containing waste: “non-hazardous”
- Dusty asbestos containing waste: “hazardous”

EU legislation (European Waste Catalogue 2014/955/EC)		Danish Legislation (Danish Statutory Order on waste, BEK 2512/2021, Annex 2)	
17 06	Insulation materials and asbestos-containing construction materials	**17 06**	Insulation materials and asbestos-containing construction materials
17 06 01*	Insulation materials containing asbestos	**17 06 01***	Insulation materials containing asbestos
17 06 03*	Other insulation materials consisting of or containing hazardous substances	**17 06 03***	Other insulation materials consisting of or containing hazardous substances
17 06 04	Insulation materials other than those mentioned in 17 06 01 and 17 06 03	**17 06 04**	Insulation materials other than those mentioned in 17 06 01 and 17 06 03
17 06 05*	Construction materials containing asbestos	**17 06 05**	Construction materials containing asbestos
		17 06 06*	Construction materials containing asbestos, dusty

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BEFORE DEMOLITION

PDA - Screening and sampling of hazardous materials
Photo: DTI

Building decontamination
Photo: VCØB

- Building owners:
  - Screen for hazardous compounds in buildings before demolition/renovation (desktop study/visual inspection)
    - Asbestos, metals, PCBs, PAHs, chlorinated paraffines …
  - Perform a pre-demolition audit (PDA) (sampling and analysis)
- Building decontamination *before* demolition
  - 2 different steps (different or same company)
  - Strict requirements on the working environment (e.g. ventilation, shorter shifts, use of personal protections)
  - Demolition/decontamination company responsible for safe and correct transport and management of ACW

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MANAGEMENT OF ACW

Photo: DTI

- Main treatment: landfilling (at approved facilities)
  - In some cases export for landfilling in underground storage facilities
  - Small amounts reported as recovered/incinerated: misreporting
- Recycling/preparation for reuse not allowed
- Incineration not practiced
  - No incineration plants allow asbestos-containing waste

LANDFILLING OF ASBESTOS CONTAINING WASTE

Photo: Deponi Syd

- Landfill for mixed waste or mineral waste
  - No hazardous substances other than asbestos
- Separate cell or separate disposal unit
- Daily cover to avoid the spreading of fibres, e.g. soil (min 0.2 m)
- If not wrapped in plastic, moistened regularly
- No compaction of landfilled ACW, no unnecessary vehicle traffic
- Final cover on the disposal unit ASAP
- Measures for tracing, locating and limiting access on landfilled asbestos

WASTE CONTAINING ASBESTOS AND OTHER POLLUTANTS

Photo: DTI

- Waste containing asbestos + other problematic substances (e.g. PCBs, PAH, metals) in concentrations > hazardous waste
- Incineration of asbestos-containing waste not practiced
- Presence of organic substances and metals limits the possibilities for landfilling
- Currently no solution:
  - Stored at waste management facilities, awaiting a permanent solution (e.g. export).

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THANK YOU FOR YOUR ATTENTION!

Stefania Butera
Danish Technological Institute
stbu@dti.dk

Management of asbestos waste in the EU: policies and practices

Case study of asbestos waste management in Germany

Olaf Dünger, Arcadis Germany GmbH

Thursday, June 15, 2023

Agenda

Development of Amounts

Classification – new regulations

Pre Demolition Audits (PDA)/ Asbestos Cadastres

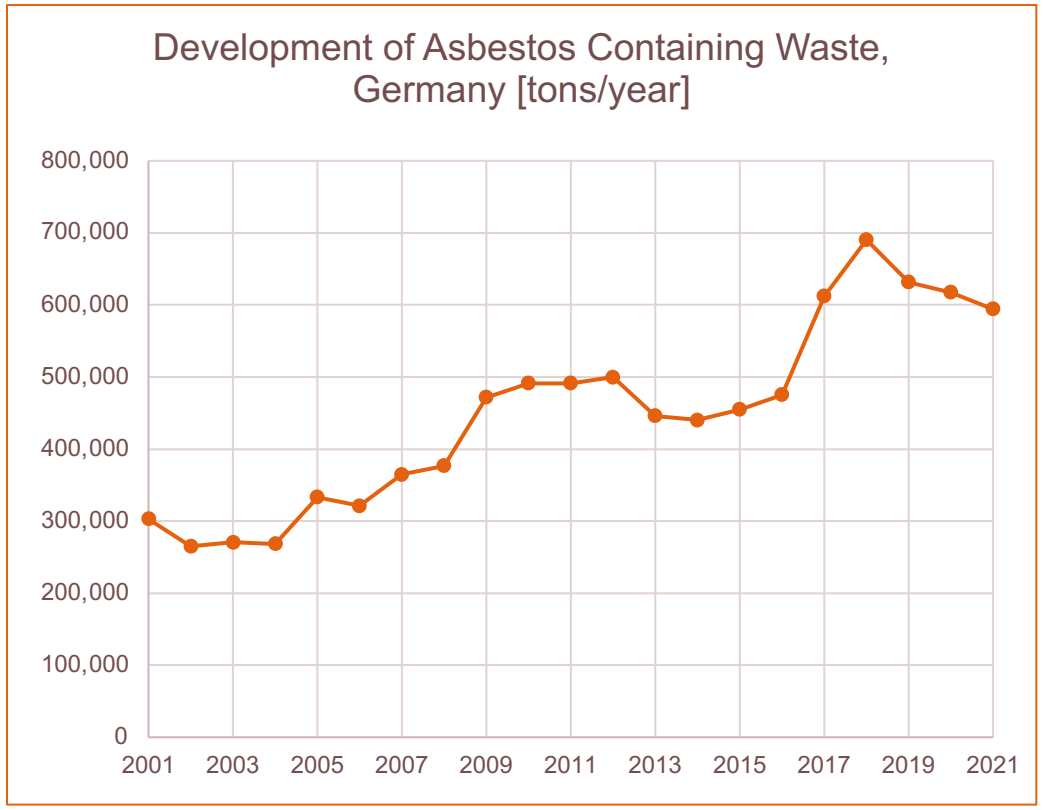
Planning Process, Education

Demolition, remediation and maintenance work

Management of AWC

Development of Asbestos Containing Waste (ACW)

ACW Development Germany



- ACW primarily from Construction / Demoliton sector
- Increasing amounts during the last decade
- Between ~ 300,000 - 700,000 t/year
- Currently ~ 600,000 t/year
- (Imported amounts not included;
  Import Peak in 2011 ~ 400,000 t/year)

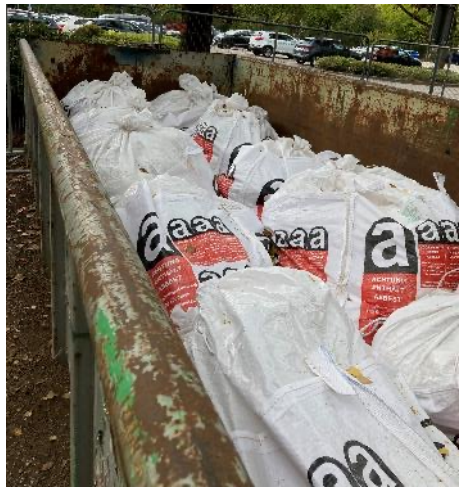


Figure 1: Development of Asbestos Containing Waste in Germany in the years 2001-2021
source Statistisches Bundesamt (Destatis, German Federal Statistical Office)

Pictures: Arcadis Germany GmbH

Classification of ACW

Identical Regulations EU – Germany (AVV)

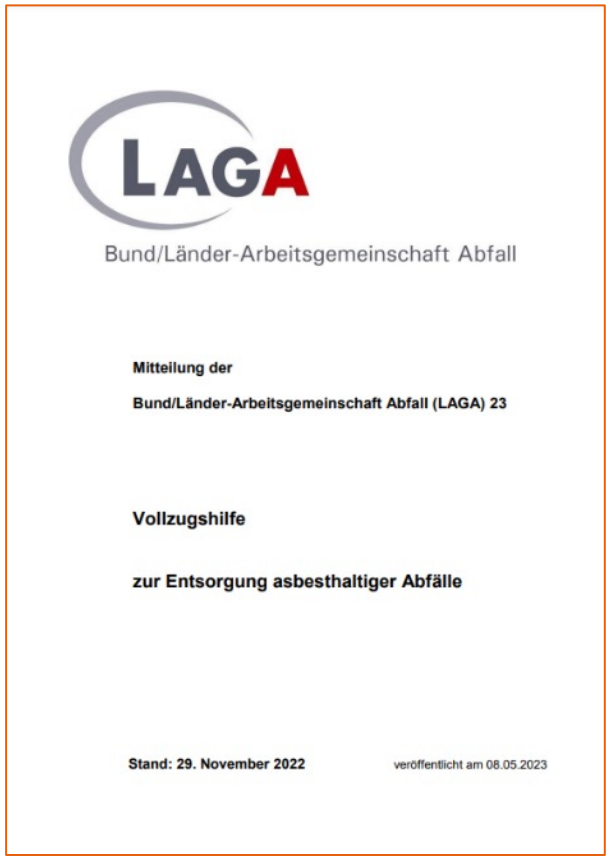
EU legislation (European Waste Catalogue 2014/955/EC)		German Regulation (Waste Catalogue Ordinance / Abfallverzeichnis-Vordnung AVV)	
17 06	Insulation materials and asbestos-containing construction materials	17 06	Insulation materials and asbestos-containing construction materials
17 06 01*	Insulation materials containing asbestos	17 06 01*	Insulation materials containing asbestos
17 06 03*	Other insulation materials consisting of or containing hazardous substances	17 06 03*	Other insulation materials consisting of or containing hazardous substances
17 06 04	Insulation materials other than those mentioned in 17 06 01 and 17 06 03	17 06 04	Insulation materials other than those mentioned in 17 06 01 and 17 06 03
17 06 05*	Construction materials containing asbestos	17 06 05	Construction materials containing asbestos

Threshold of 0.1 Mass-%
Above or equal: hazardous waste
Below: non hazardous waste

New German Regulation concerning ACW - LAGA M23

Implementation Guide for the Disposal of Waste Containing Asbestos

Federal Government / Federal State Waste Working Group, Nov. 2022


LAGA

Bund/Länder-Arbeitsgemeinschaft Abfall

Mitteilung der

Bund/Länder-Arbeitsgemeinschaft Abfall (LAGA) 23

Vollzugshilfe

zur Entsorgung asbesthaltiger Abfälle

Stand: 29. November 2022 veröffentlicht am 08.05.2023

New Introduction of an **assessment value of 0.010 mass-% („Beurteilungswert“)**, which, if fallen below, defines an "asbestos-free" status and subsequently declares a recyclable building material.
Dilution remains forbidden.

Disposal Regular disposal route landfill		Recycling (RC building material)
Hazardous Waste	Non-hazardous Waste	Asbestos free Waste
≥ 0.1 Mass%	> 0.010 < 0.1 Mass%	< 0.010 Mass%

In Case of asbestos present as NOA (**natural component** of a mineral building material):
Re-Use as RC building material possible (section 5.1.3 of LAGA M23)

→ **Recycling**

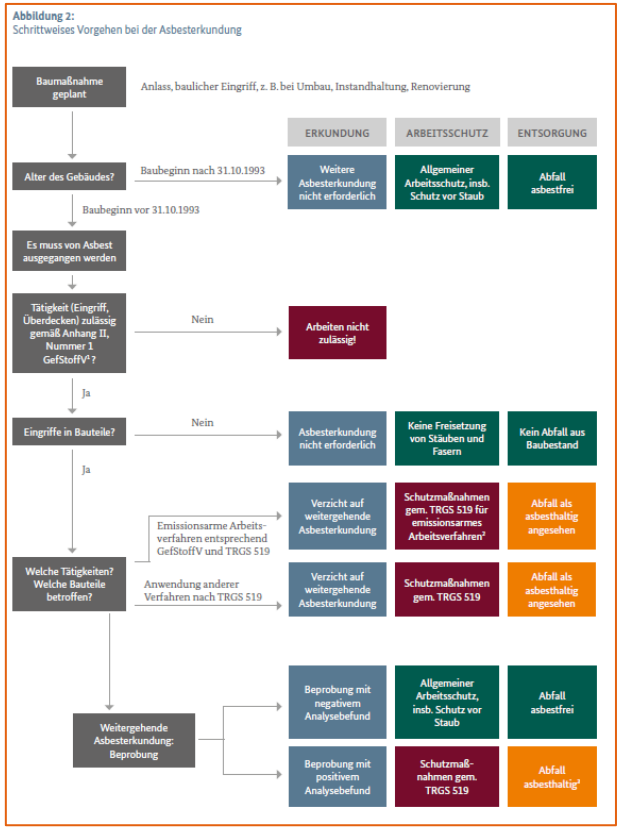
Pre Demolition Audits (Asbestos surveys / Screening and mapping for asbestos before demolition and renovation work)

Building owners

- Screen for hazardous compounds in buildings before demolition/renovation (desktop study/visual inspection)
  - Asbestos, metals, PCBs, PAHs, chlorinated paraffines …
- Perform a pre-demolition audit (PDA) (sampling and analysis)

More binding Regulations for the building owners will be implemented in the new Ordinance on Hazardous Substances (only draft law version so far).

Step by step approach – focus on construction year before 1.1.1995



https://www.baua.de/DE/Angebote/Publikationen/Kooperation/Asbesterkundung.pdf?__blob=publicationFile&v=2

Asbestos Cadastre – with focus on „new“ findings

Visible by eye

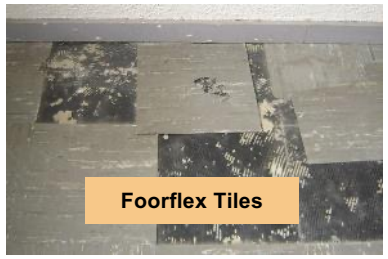
Always respected classics


Asbestos-cement


Sprayed asbestos


lightweight boards


Asbestos cord


Foorflex Tiles


Fire Protection Flaps

Special investigation required

New Focus on other Usages


AC Tile Adhesives, Thin bed glue


AC Filler, Putty, Plaster


2017: AC Concrete Spacers, Formwork anchor sleeve

Planning Process

Key components to be considered

- **Remediation concept**
  (asbestos-specific qualifications, permissibility, ban on covering, asbestos exposure and protective measures, need for low-emission processes).
- **Disposal concept**
  in accordance with the Closed Substance Cycle Waste Management Act (KrWG) and state recycling laws (e.g. in Baden-Württemberg and North Rhine-Westphalia).
- **Tendering / contract design**
  (selection of suitable companies / determination of qualifications / asbestos permit etc.)

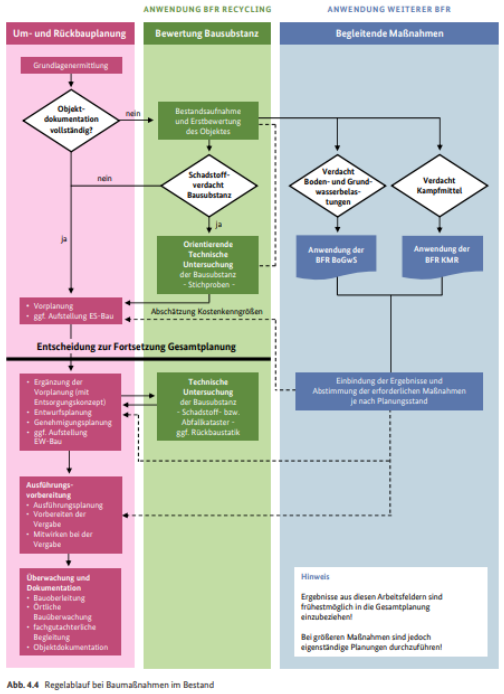


Abb. 4.4 Regelablauf bei Baumaßnahmen im Bestand

Standard procedure for construction measures in existing buildings

https://www.bfr-recycling.de/downloads/Baufachliche_Richtlinien_Recycling.pdf

Education, training, and instruction for works with asbestos

Special asbestos training

- Employers must ensure that the persons involved in the internal demolition of asbestos-containing material in buildings, ships, etc., have undergone **special asbestos training** and have a training certificate according to the regulations of the TRGS 519.

- Since in Germany, among other things, the "new" asbestos findings in **plasters / fillers / tile adhesives** have caused a new sensitivity, efforts are being made to **provide all employees working in old buildings with basic training in asbestos**. The Employer's Liability Insurance Association for the Construction Industry (BG Bau) has launched a special training campaign (basic knowledge of asbestos, e-learning course with or without test and certificate) for this purpose on a digital way including an asbestos house showing a lot of asbestos findings.

Basic Knowledge of asbestos – E-learning course by BG Bau

https://lernportal.bgbau.de/ilias.php?ref_id=62625&cmd=view&cmdClass=ilobjcontentpagegui&cmdNode=xr:mj&baseClass=ilrepositorygui

Demolition, remediation and maintenance work

GefStoffV

Verordnung zum Schutz vor Gefahrstoffen
(Gefahrstoffverordnung – GefStoffV)

Vom 26. November 2010 (BGBl. I S 1643)

geändert durch Artikel 2 des Gesetzes vom 28. Juli 2011 (BGBl. I S 1622),
durch Artikel 2 der Verordnung vom 24. April 2013 (BGBl. I S 944),
durch Artikel 2 der Verordnung vom 15. Juli 2013 (BGBl. I S 2514),
durch Artikel 2 der Verordnung vom 03. Februar 2015 (BGBl. I S 49),
durch Artikel 1 der Verordnung vom 15. November 2016 (BGBl. I S 2549),
durch Artikel 148 des Gesetzes vom 29. März 2017 (BGBl. I S 626) und
durch Artikel 2 der Verordnung vom 21. Juli 2021 (BGBl. I S 3115)

Inhaltsübersicht

Abschnitt 1
Zielsetzung, Anwendungsbereich und Begriffsbestimmungen

§ 1 Zielsetzung und Anwendungsbereich
§ 2 Begriffsbestimmungen

Abschnitt 2
Gefahrstoffinformation

§ 3 Gefahrstoffe
§ 4 Einstufung, Kennzeichnung und Verpackung
§ 5 Sicherheitsdatenblatt und sonstige Informationspflichten

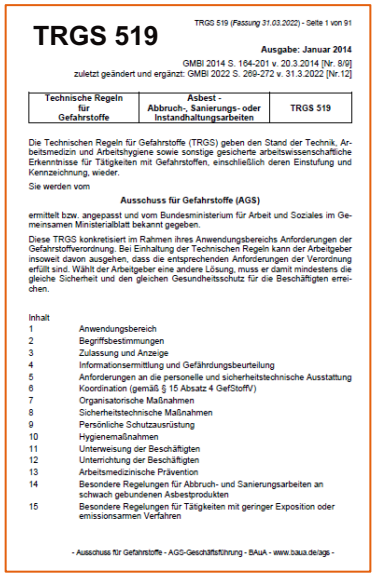
Abschnitt 3
Gefährdungsbeurteilung und Grundpflichten

§ 6 Informationsermittlung und Gefährdungsbeurteilung
§ 7 Grundpflichten

Abschnitt 4
Schutzmaßnahmen

§ 8 Allgemeine Schutzmaßnahmen
§ 9 Zusätzliche Schutzmaßnahmen

Bundesanstalt für Arbeitsschutz und Arbeitsmedizin (BAuA) – www.baua.de



TRGS 519

TRGS 519 (Fassung 31.03.2022) - Seite 1 von 91

Ausgabe: Januar 2014

GMBl 2014 S. 164-201 v. 20.3.2014 [Nr. 8/9]
zuletzt geändert und ergänzt: GMBl 2022 S. 269-272 v. 31.3.2022 [Nr.12]

Technische Regeln für Gefahrstoffe	Asbest - Abbruch-, Sanierungs- oder Instandhaltungsarbeiten	TRGS 519

Die Technischen Regeln für Gefahrstoffe (TRGS) geben den Stand der Technik, Arbeitsmedizin und Arbeitshygiene sowie sonstige gesicherte arbeitswissenschaftliche Erkenntnisse für Tätigkeiten mit Gefahrstoffen, einschließlich deren Einstufung und Kennzeichnung, wieder.

Sie werden vom

Ausschuss für Gefahrstoffe (AGS)

ermittelt bzw. angepasst und vom Bundesministerium für Arbeit und Soziales im Gemeinsamen Ministerialblatt bekannt gegeben.

Diese TRGS konkretisiert im Rahmen ihres Anwendungsbereichs Anforderungen der Gefahrstoffverordnung. Bei Einhaltung der Technischen Regeln kann der Arbeitgeber insoweit davon ausgehen, dass die entsprechenden Anforderungen der Verordnung erfüllt sind. Wählt der Arbeitgeber eine andere Lösung, muss er damit mindestens die gleiche Sicherheit und den gleichen Gesundheitsschutz für die Beschäftigten erreichen.

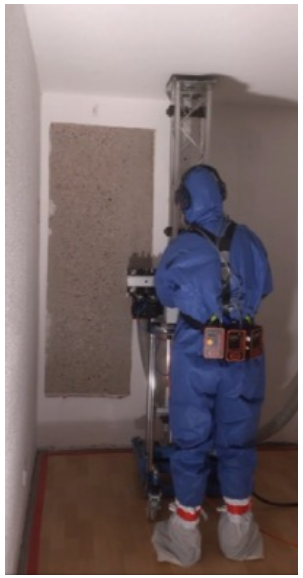
Inhalt

1 Anwendungsbereich
2 Begriffsbestimmungen
3 Zulassung und Anzeige
4 Informationsermittlung und Gefährdungsbeurteilung
5 Anforderungen an die personelle und sicherheitstechnische Ausstattung
6 Koordination (gemäß § 15 Absatz 4 GefStoffV)
7 Organisatorische Maßnahmen
8 Sicherheitstechnische Maßnahmen
9 Persönliche Schutzausrüstung
10 Hygienemaßnahmen
11 Unterweisung der Beschäftigten
12 Unterrichtung der Beschäftigten
13 Arbeitsmedizinische Prävention
14 Besondere Regelungen für Abbruch- und Sanierungsarbeiten an schwach gebundenen Asbestprodukten
15 Besondere Regelungen für Tätigkeiten mit geringer Exposition oder emissionsarmen Verfahren

- Ausschuss für Gefahrstoffe - AGS-Geschäftsführung - BAuA - www.baua.de/ags -

Building decontamination *before* demolition

- Strict requirements on the working environment (detailed regulations in the GefStoffV and TRGS 519, e. g. ventilation, personnel lock, shorter shifts, use of personal protections)
- Ongoing Discussion in Germany whether the Demolition / decontamination company or the owner is responsible for safe and correct transport and management of ACW
- Development of low emission work procedures (DGUV Information 201-012)



Picture: ASUP, equipment for the low emission work procedures BT43 / BT 44.

Unsuccessful Treatment / Management of ACW in the past – experience from former research projects

A study of the Kernforschungszentrum Karlsruhe from September 1994 summarizes the state of the art as follows:

"***At present none of the treatments fulfill the demands of being low in energy consumption, reducing waste volume and permitting a total destruction of the asbestos structures with the possibility of reusing the products.***"

"*Status of the treatment and disposal of residual materials containing asbestos 1994, I. Jovanovic, Project Low-Pollution and Low-Waste Processes*"

https://publikationen.bibliothek.kit.edu/270036038/4146901

In the 1990s some research projects took place in Germany to avoid deposition of asbestos containing materials.

The following different treatment methods and combination of them were tested:

- Mechanical shredding processes
- Thermal processes and vitrification (glazing)
- Tempering
- Chemical processes

All above mentioned treatment methods are categorised until today as not suitable in Germany due to drawbacks like no efficient destruction of the asbestos fibres, high costs and still uncertainties regarding the full desctruction of the fibres.

➡ **Germany puts focus on complete detection and separation of ACM.**

Management of ACW

Main treatment: landfilling (at approved facilities)

- In most cases landfilling
  - No hazardous substances other than asbestos
  - Separate cell or separate disposal unit
  - Daily cover to avoid the spreading of fibres, e. g. soil (minimum 0.25 m)
  - If not wrapped in plastic, moistened regularly
  - Final cover on the disposal unit ASAP
  - Measures for tracing, locating and limiting access on landfilled asbestos
- In some cases landfilling in underground storage facilities (depending on Federal States Regulations)
  - Waste containing asbestos + other problematic substances (e.g. PCBs, PAH, metals) in concentrations > hazardous waste
  - Incineration of asbestos-containing waste not practiced
  - Presence of organic substances and metals limits the possibilities for landfilling

Recycling / preparation for reuse

- Not allowed

Incineration

- The incineration facilities are not licensed to accept asbestos-containing waste.

Picture: Arcadis Germany GmbH

Picture: Underground storage facility (K+S)

https://www.kpluss.com/de-de/geschaeftsfelder-produkte/entsorgung/#entsorgungsl-sungen

Thank you for your attention!

Olaf Dünger, Arcadis Germany GmbH

Thursday, June 15, 2023

Discussion questions

- What are the **most important elements of a national asbestos management strategy** in your opinion? Why are these elements important?
- What are the measures or actions in the existing national strategies or other initiatives on asbestos waste management that can be considered **best practice**? What can we learn from their implementation?
- What **challenges are currently faced** by EU Member States that have developed (are developing or want to develop) programmes and initiatives to support the implementation of their national strategies?
- Which elements should be part of a strategy at the **EU level**? Why do you think the EU action is needed?

RPA Europe

Thank you!

If you have questions or wish to provide more information, please contact us at: asbestos.waste@rpa-europe.eu

RPA Europe

Lunch break

Back at 13:30 CET

RPA Europe

Current and emerging technologies for the treatment of asbestos waste

Discussion session

15 June 2023

Zinaida Manžuch & Rūta Akelytė,
RPA Europe

Warm-up exercise

Imagine if developing asbestos waste treatment technologies was a sport. **Which of these sports describes the current situation in asbestos waste treatment technologies in the best way?**

(A) WEIGHTLIFTING

(B) SYNCHRONISED SWIMMING

(C) SHOOTING

(D) TRIATHLON

(E) BOXING

(F) ROWING

RPA Europe

Asbestos waste treatment technologies

Nicolas Humez

HAZARDOUS WASTE EUROPE HWE

RPA Europe

DEEPTECH, CLEANTECH

ASBETER HOLDING

ACTIVE & CIRCULAR

AC MINERALS

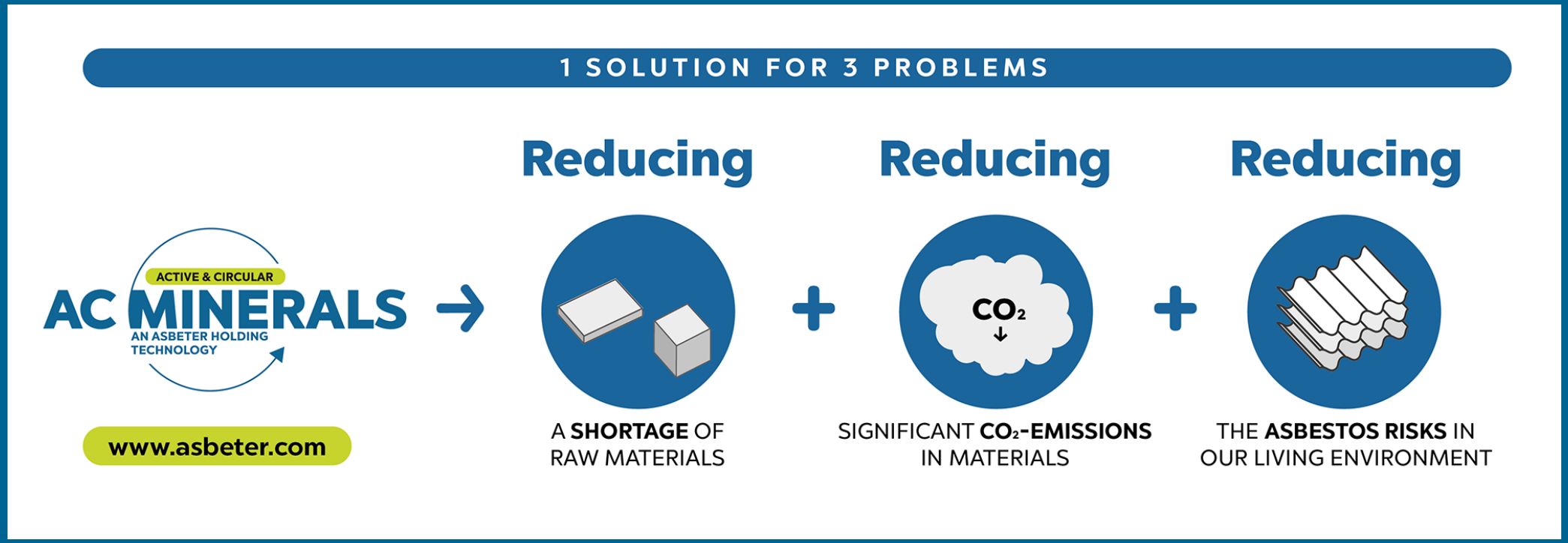
AN ASBETER HOLDING TECHNOLOGY

We make asbestos fibres **disappear**!

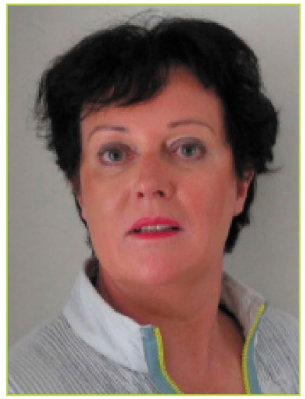
We developed the patented AC Minerals process that **completely dissolves** asbestos fibres and **recovers carbon-neutral raw materials** in a **circular** way.

Circular solution

AC Minerals process
dissolves asbestos fibres
and
recovers carbon-neutral raw materials



Asbeter Management Team

				
Drs. Inez Postema	Drs. Jos Hofs	Drs. Jan Evert Post	Cornelis van der Burg Msc	Ing. Paul de Vries
CEO	CFO	CIO	Head of R&D	Project Manager
Strategy & Impact; Market develop-ment. Managing Director demonstration plant.	Business case, risk management, financial control & HR.	Funding strategy, raising equity & debt capital.	R&D Process and products; Market development.	Engineering projects and procurement, Project manage-ment.

Asbeter's AC Minerals Process needs only water + energy

PRE-TREATMENT

- **Fine milling** of asbestos cement (in strictly contained area) to create more **reaction surface.**

CHEMICAL PROCESS

- Water added, creating an **alkaline environment** in which the solution reaction starts. Slurry is heated to accelerate reaction. **Asbestos fibres are dissolving.**

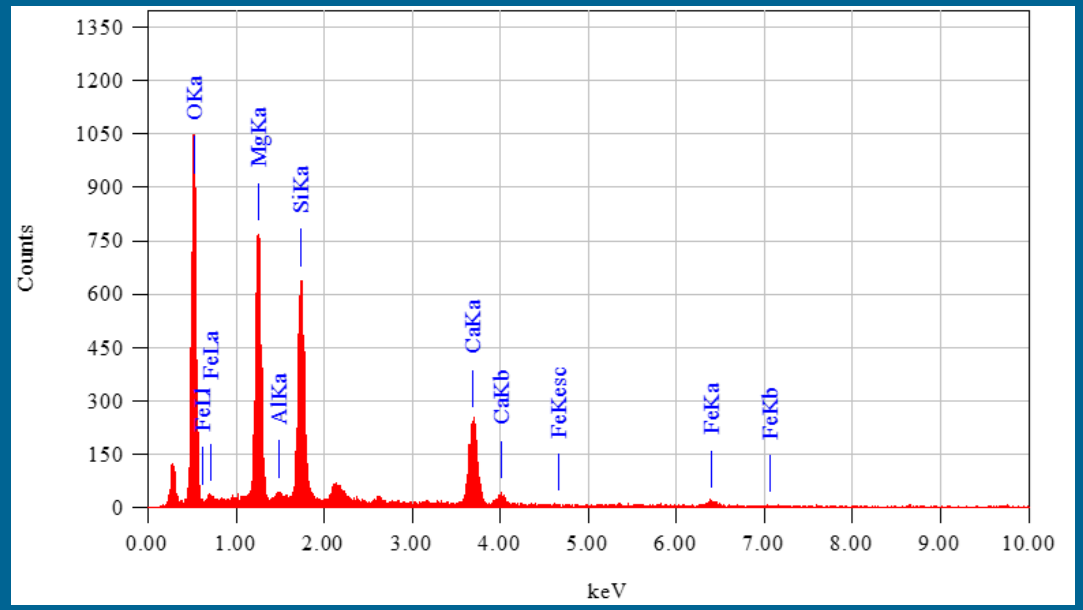
FINAL POLISHING

- Fine milling creates additional heat to **continue chemical reaction** and ensure that all asbestos fibres are effectively **dissolved.**

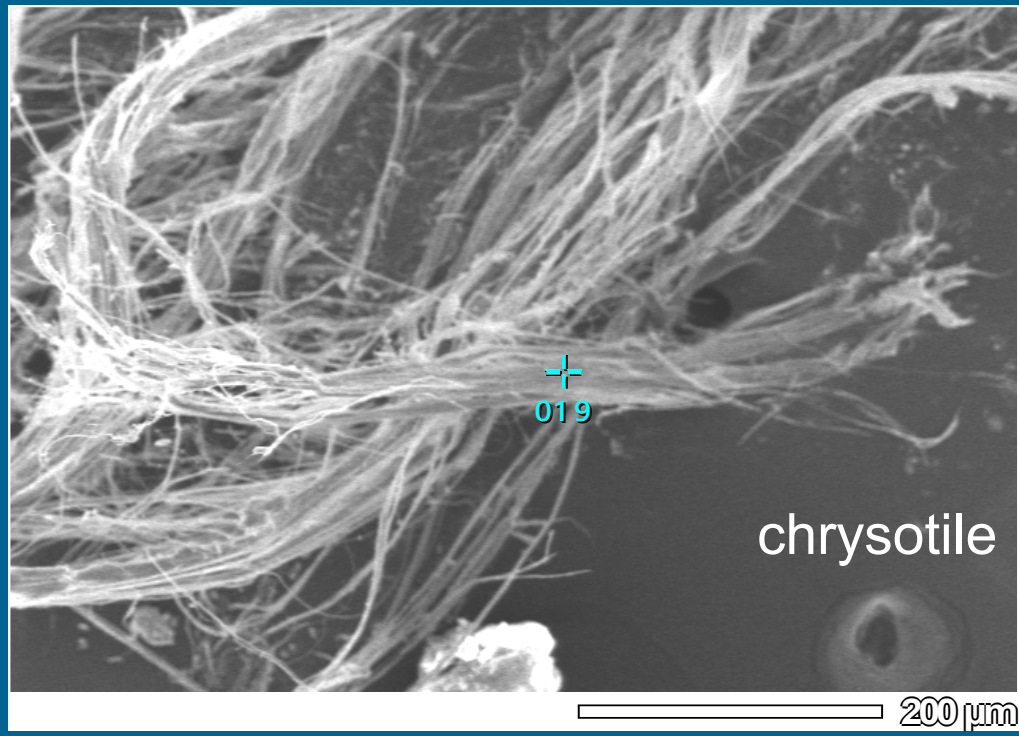
Carbonisation of end product offers extra **CO2 credits**, attractive to offtakers

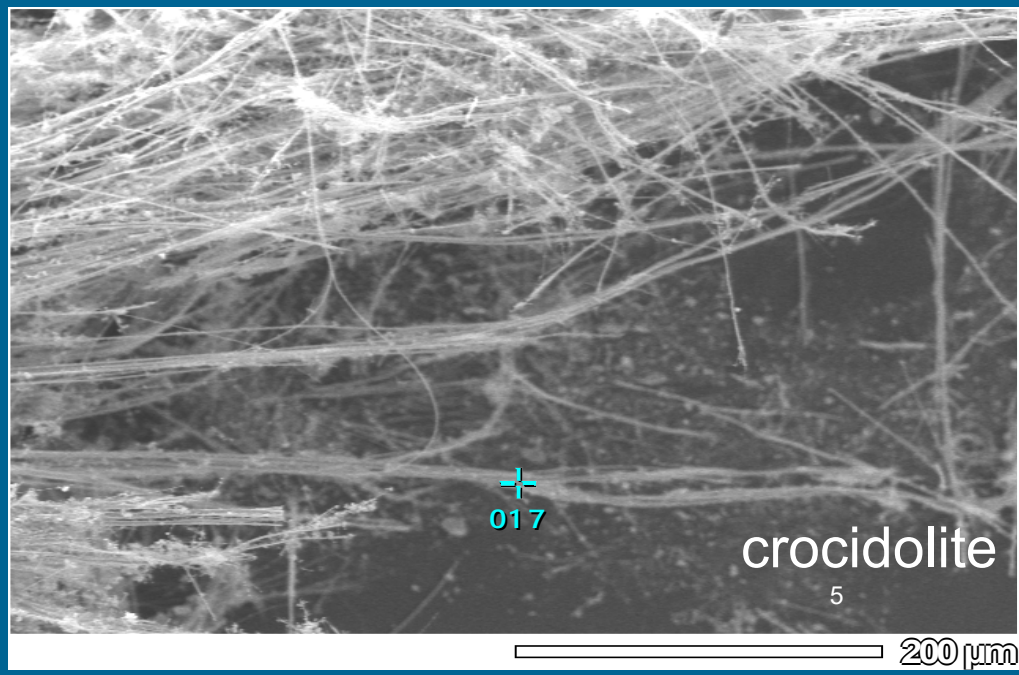
Asbestos Cement

- Asbestos Cement (AC) contains 10-15% asbestos
- Both chrysotile and crocidolite occur
- Chrysotile: typical 1:1 ratio of Mg/Si
- Crocidolite: presence of Fe and Na



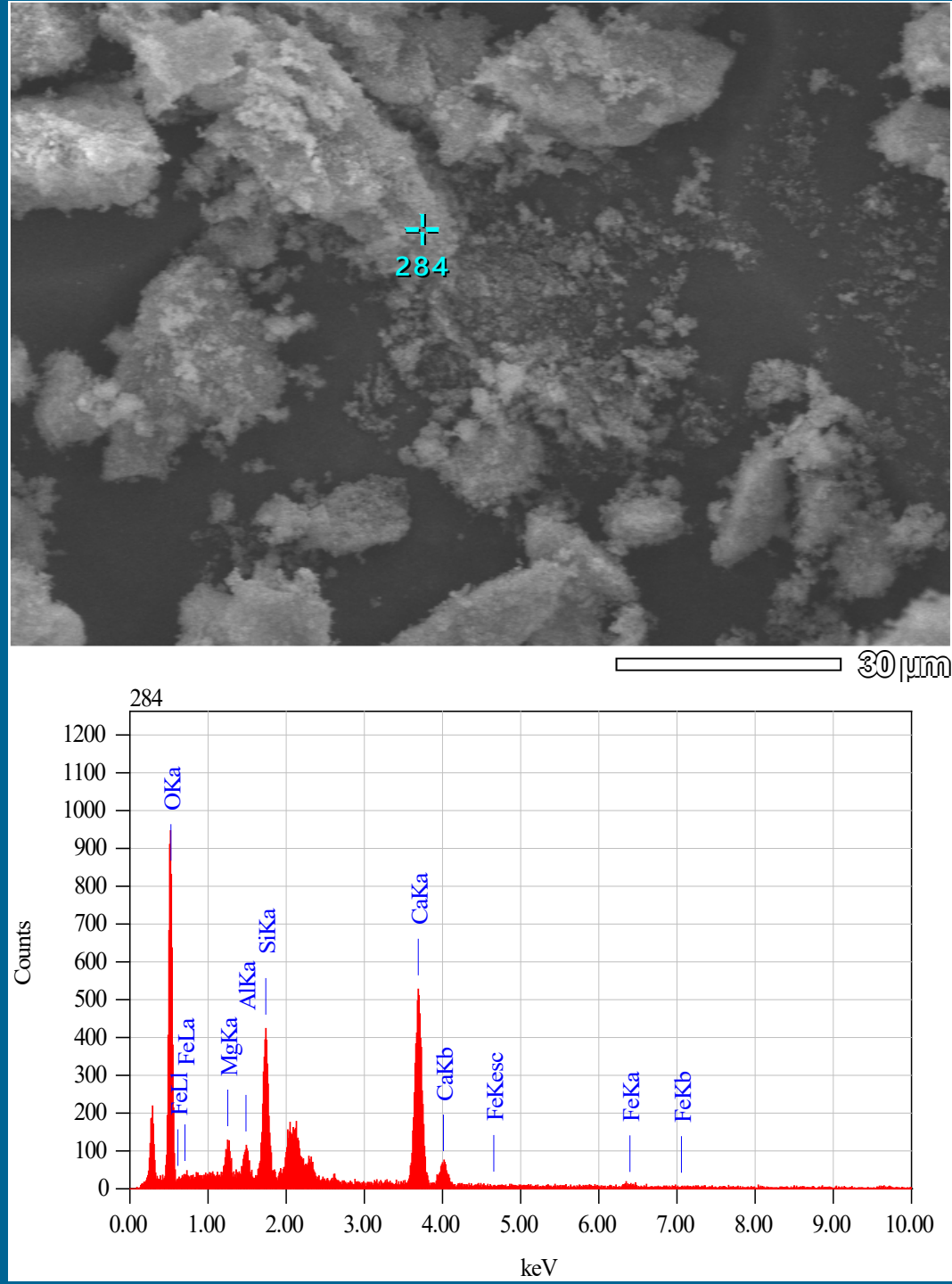
Magnesium peak: chrysotile asbestos





End product

- End product is thoroughly examined by external Asbestos Laboratory SGI Compliance in Rotterdam.
- Sample preparation: sludge is dried
  - No asbestos can be found using Polarized Light Microscopy
- SEM analysis on 40 image fields with magnifications up to 5000x.
  - No fibres present
  - Composition is the homogeneous throughout sample.
  - No typical asbestos Mg/Si ratios



Asbeter introduced a new standard: *ZERO* fibres in the end product

DNV

NV PRJC_221104

VERIFICATION STATEMENT

The process for the decomposition of asbestos fibres from cement in a wet process and designed to make chrysotile, amosite and crocidolite asbestos from asbestos containing materials like cement and calcium shells as insulation material into a completely asbestos-free residue

Asbeter Holding trading name Asbeter (DCC number 71532331)

DNV Business Assurance B.V. (DNV) has verified the intended result of the aforementioned process on behalf of ASBETER HOLDING, TRADING NAME ASBETER, in accordance with DE NORMKADERBEPALING ASBETER. The process is laid down in: “Procesbeschrijving AC Minerals: 20 februari 2023

Further details of the validated:

The AC Minerals process is a mechanical-chemical process in three main steps, preceded by an essential dry mechanical breaking and separation process, the pre-treatment. Asbestos containing materials like cement can be supplied in various forms. Some examples of this are water pipes, gas pipes, roof plates but also calcium shells as insulation material.

The assessment was aimed at verifying the outcome of the process of completely decomposition of asbestos fibres (Chrysotiel, Amosite and Crocidolite) from asbestos containing materials (cement) and calcium shells as insulation material. The verification of the process and the results of the process has been conducted in accordance with the verification scheme established by DNV “DE NORMKADERBEPALING ASBETER".

Overall conclusion

The overall conclusion rests upon the finding that, inter alia on the basis of the assessment work conducted by DNV, it has become apparent that the described and followed process "Asbeter Holding Normkader-DNV, Asbeter introduction drawn up by the Asbeter Holding on 20-02-2023" leads to the demonstrable decomposition of asbestos fibres (Chrysotiel, Amosite and Crocidolite) from asbestos containing materials like

End-of-waste declaration for our end products

DCMR milieudienst Rijnmond

Parallelweg 1
Postbus 843
3100 AV Schiedam
T 010 – 246 80 00
E info@dcmr.nl
W www.dcmr.nl

Asbeter Holding B.V.
T.a.v. mevrouw I Postema
Röntgenweg 11
3208 KG Spijkenisse

Ons kenmerk	Uw kenmerk	Datum
200657_4776114		01 juni 2023
Contact	**Afdeling**	**Bijlagen**
info@dcmr.nl	Reguleren Advies en Omgeving	1

Onderwerp
Rechtsoordeel einde afval Asbest

Geachte mevrouw Postema,

Op de 13 april 2023 heeft u een verzoek ingediend om een rechtsoordeel over de vraag of de door u geproduceerde Calcium Silicaat Hydraat (CSH) vanuit verwerkt asbestcement (Eural code 17 06 05)

Conclusion

Based on our assessment and on the basis of the submitted documents under the given circumstances, the Calcium Silicate Hydrate (CSH) produced from asbestos waste material with the AC Minerals process can be regarded as end-of-waste, which means that it does not constitute waste in the sense of Article 1.1(1) of the Wm (*Wet milieubeheer* – Environmental management act).

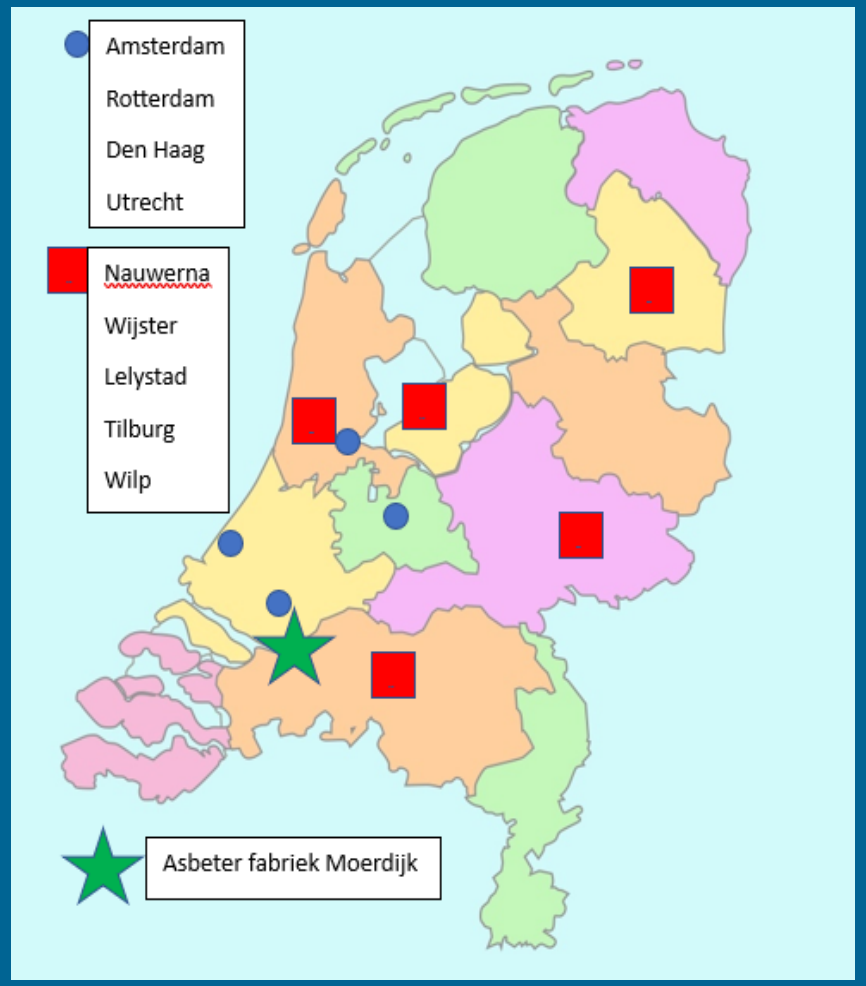
Environmental cost indicator

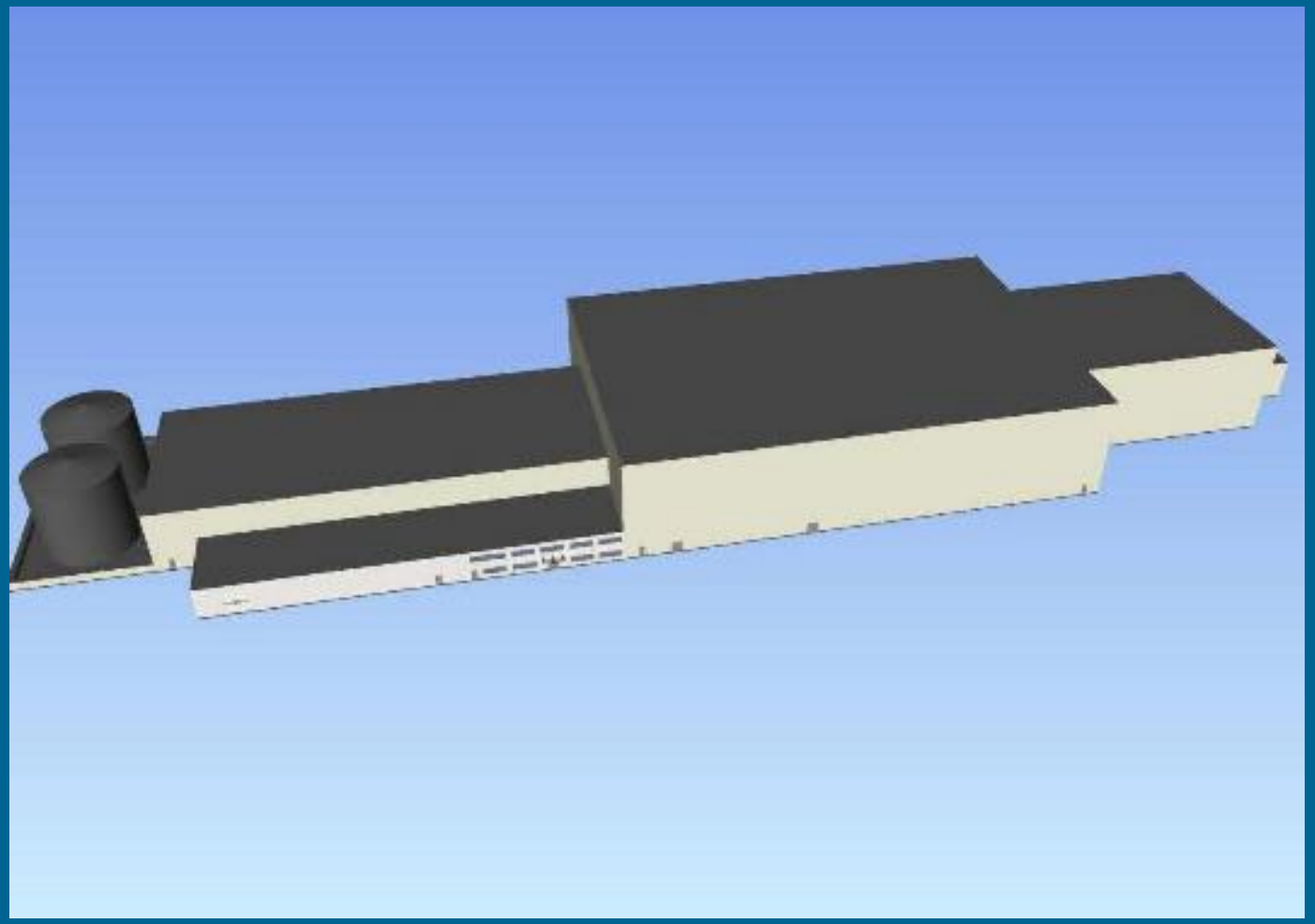
Environmental costs AC Minerals calcium silicate slurry 50% ds: € 0,0007/kg

Replacement for:

CEM I 52.5 R =	€ 0.069 /kg
CEM III/B 42.5 N =	€ 0.025/kg
Talc (from clay) =	€ 0.002/kg
Calcium carbonate =	€ 0.16/kg
Titanium dioxide =	€ 0.74/kg

Source: LCA study SGS Intron



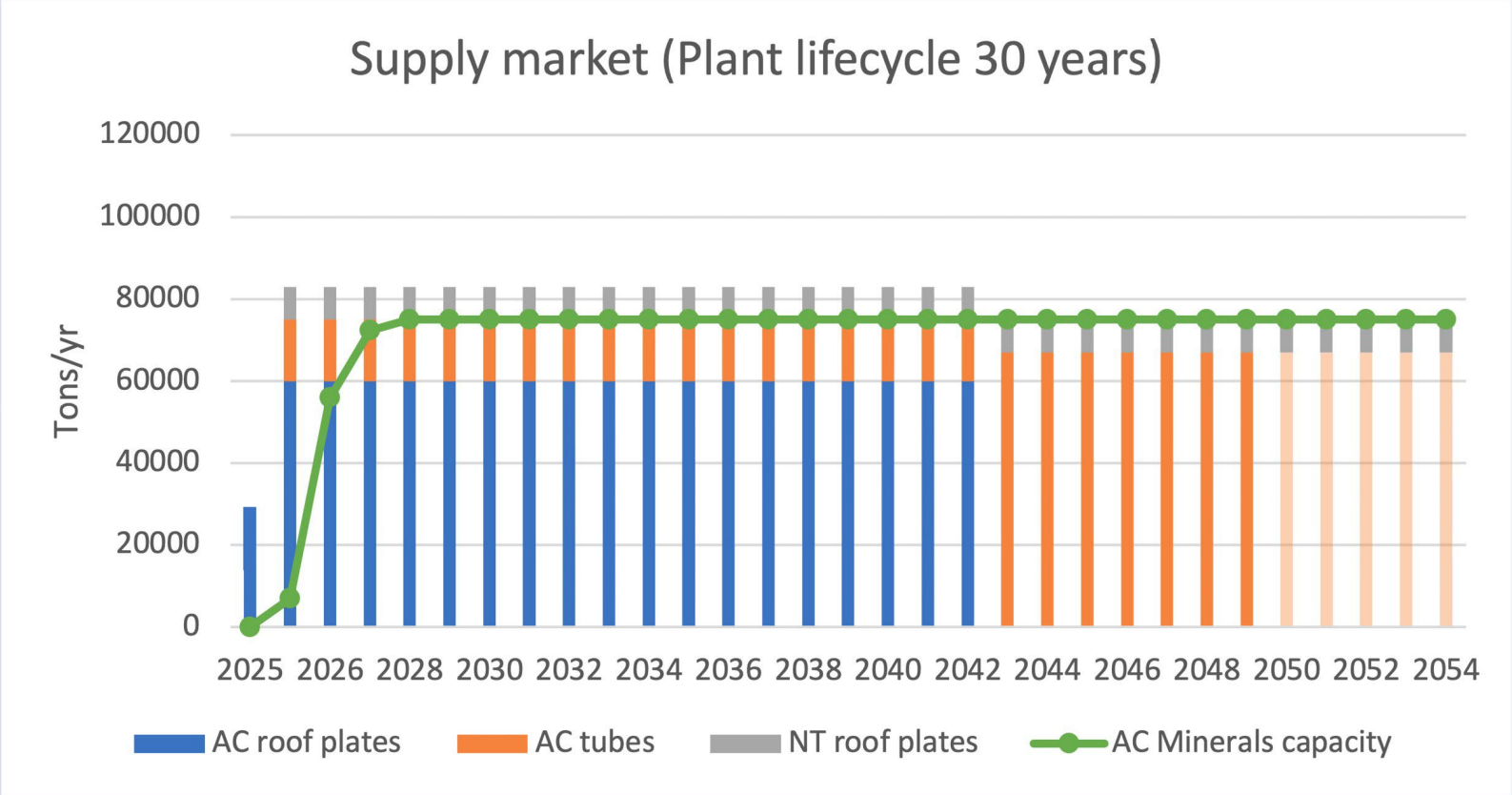


From regional storage to processing plant

Safe, closed handling from demolition to intermediate storage to processing plant

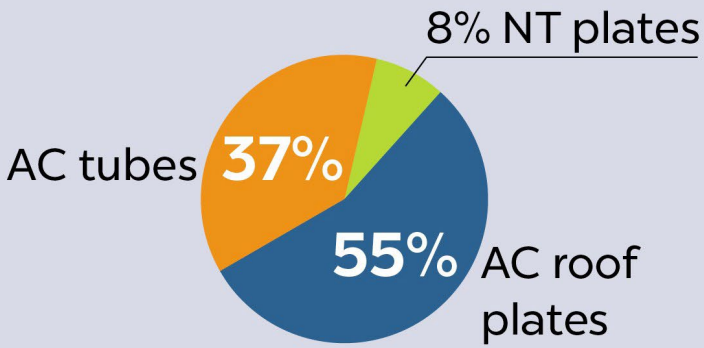
Volume 2,000,000 tons AC with capacity of 75,000 tons/year

Scenario AC Supply and Remediation NL Plant



Supply Market Mix

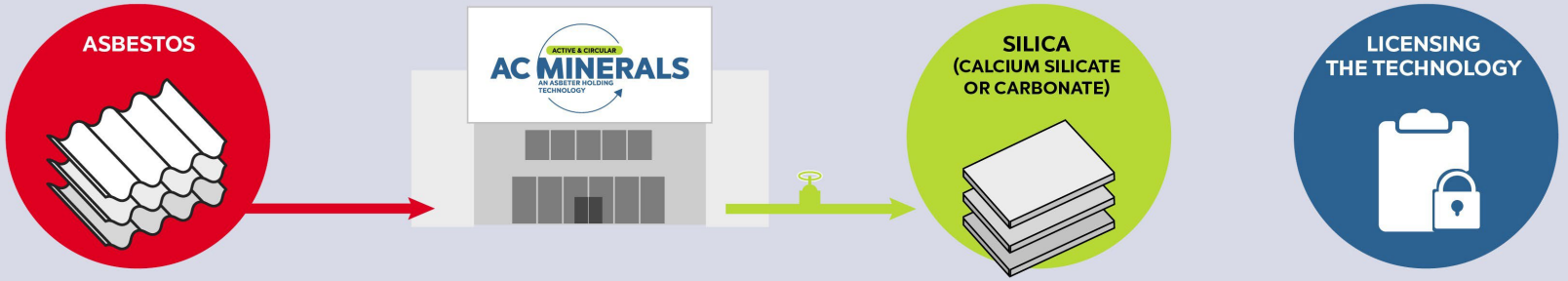
AC roof plates	1,200,000
AC tubes	800,000
NT plates	170,000



Value chain: techno-economic feasibility at €400/ton

Business model incl. licensing

Model based on 3 revenue streams: total €36+ mln/yr by 2027



Revenue stream 1
75 Kton/yr of asbestos cement waste intake for fixed tariff set by Dutch govt
2025: est. €251/ton
likely increase of 10% per 5 yrs as inflation adjustment
2027: €19 mln/yr

Revenue stream 2
>124 Kton/yr silicate end product.
Delivered as raw material to industry at average of €73.5/ton (slurry 50% dry)
2027: €10 mln/yr

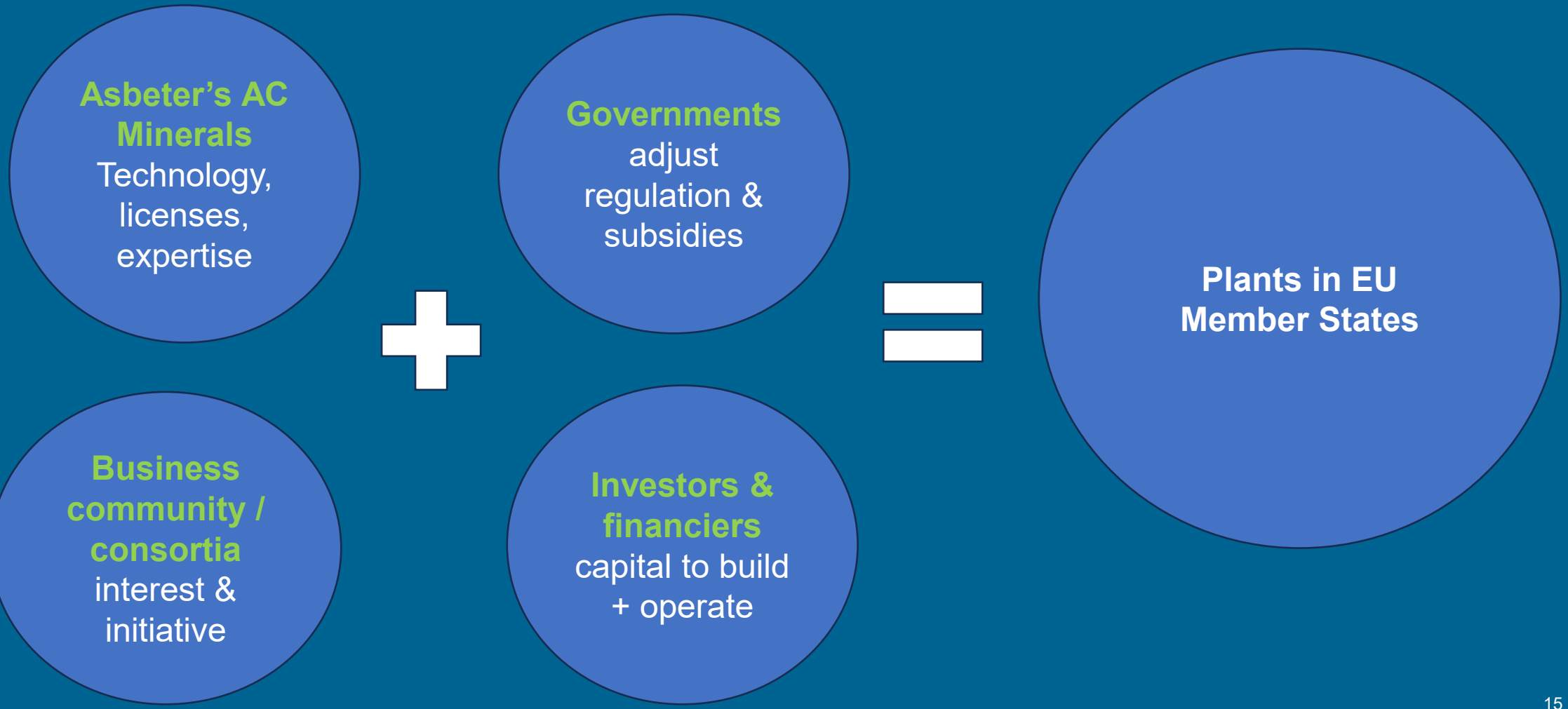
Revenue stream 3
Licensing technology to partners outside The Netherlands
Fixed & variable fee based on volume of processed asbestos cement.
2027: €7mln/yr

Total costs €24 mln
- Direct process costs (water & energy) €15 mln
- Organizational costs € 6 mln
- Depreciation & Amortization Factory in 25 yrs €3 mln

EBIT €5 mln
- Production starts in Q2 2025
- Full capacity in Q3 2026
- Lifetime 25+ years

Licensing €7 mln
- Upfront fee €2,5 mln
- Signing fee €4,5 mln

Together, we can (dis)solve the problem that asbestos cement poses in Europe



A transition that matters

You are welcome to visit us at

Asbeter AC Minerals Plant

Röntgenweg 11
3208 KG Spijkenisse
The Netherlands
contact@asbeter.com

Discussion questions

- What are the **key characteristics of the technologies** that make them the most promising? Are there data (e.g. from pilots) to back up these advantages?
- What are the main **barriers to the commercialisation** of the technologies? Can you provide examples?
- What can be done to **overcome these barriers**? Can we draw any parallels with other technologies/sectors from which we could learn and get inspired?
- What are the output **materials** obtained by the different treatment technologies? What are their safety profiles and potential uses? And do they have a market?

RPA Europe

Thank you!

If you have questions or wish to provide more information, please contact us at: asbestos.waste@rpa-europe.eu

RPA Europe

Break

Back at 15:30 CET

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Presentation of discussion outcomes and wrap-up

RPA Europe