Management of asbestos in recovered fines and recovered materials for beneficial reuse in NSW

Discussion Paper – Submission Form

Submitter Details

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Email/phone: [redacted]

If this is a confidential submission, please tick here: ☐

Responses to questions

You can respond to any questions that are relevant to you. If you only want to submit data or any other relevant information, please email them to asbestosreview@chiefscientist.nsw.gov.au.

Thresholds and screening levels

Question 1: What factors should be considered when deriving a threshold or screening level for asbestos in recovered fines and material for beneficial reuse?

For a **threshold**, the Western Australia's threshold 0.05% w/w seems reasonable and practical since the practical limit of detection by the qualitative method described by AS 4964 has a limit of detection between 0.01 and 0.1%. We believe however that more urgent is to improve the quality, consistency and coverage of the sampling methods. WA's guidelines also cover coverage and sampling.

For a **screening level**, a sound method is to use an Acceptance Quality Level (AQL), defined in **ISO 2859-1** (also known as AS 1199.1) as the "quality level that is the worst tolerable". The AQL tells you how many defective components are considered acceptable during random sampling quality inspections. If using the WA limit, as an example, this AQL would be 0.05% w/w. Further, the ISO standard starts with General Inspection Levels, but also defines what to do if based on the lot sampling one finds that the AQL is not met in that case the standard defines more stringent screening levels (called tightened inspection - Special Inspection Levels) for that supplier (untrusted supplier); similarly if the AQL is consistently met by a given supplier the standard defines a more lose screening level (called reduced inspection, for trusted supplier). This way the screening level is dynamically adjusted or relaxed over time as one builds or loses trust on the supply chain, in other words it **adapts the screening based on risk.**

In addition, since this is a method based on sampling, and sampling can be prone to human error or trickery, it will be important to ensure that sampling is truly done randomly and in a manner that

approximates the totality of the material. So, in the case of sampling as a percentage of w/w, it would be important that samples are obtained from different parts of the total pile/stock.

Asbestos waste management at recycling facilities

Question 2: Can you provide any data on annual volumes of C&D waste being recycled or alternatively sent to landfill? Data on rejected loads due to asbestos presence and any other data related to all TOR items is welcomed.

Please email data together with this form to asbestosreview@chiefscientist.nsw.gov.au

Question 3: Can you provide any other information on the potential presence of asbestos in recycled C&D material?

i. Information on the methods of separating and removing asbestos from waste that can inform alternative approaches?

ii. What reuse scenarios are there for recycled waste, including end-products and their use?

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Question 4: While this section focuses on C&D waste, are there other waste types which are suitable for beneficial reuse which have the potential to be contaminated with asbestos?

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Management of asbestos in soil

Question 5: Is it appropriate for the health screening levels for asbestos in soils to apply to asbestos in waste? Note that the threshold level in this instance refers to a level where further action is required.

i. Why or why not?

We believe it is appropriate for the same limit to apply at any point in the supply chain, where the waste product that contains asbestos can be in the same level of contact with humans as soil is (no PPE required, no warning signs or other risk mitigations).

But for the segments of the supply/value chain (for example during transport or storage) where the asbestos containing waste can be clearly identified and risk can be mitigated via other methods (e.g. PPE, warnings, containment) then a different threshold level can be considered.

Once deployed into soil however, the overall % w/w of asbestos in the [soil + waste] should be under to the soil threshold.

Question 6: Health screening levels are not the only tool used for managing asbestos in soils. If threshold levels in soils were to be applied to asbestos in **waste for beneficial reuse**,

i. what other tools can support managing asbestos in waste for beneficial reuse?
ii. what would be the limitations, costs or feasibility of safely removing asbestos in waste?
iii. are there certain scenarios where recycled C&D material should not be reused?

iv. are there certain scenarios where reuse of recycled C&D material could result in land legacy issues?

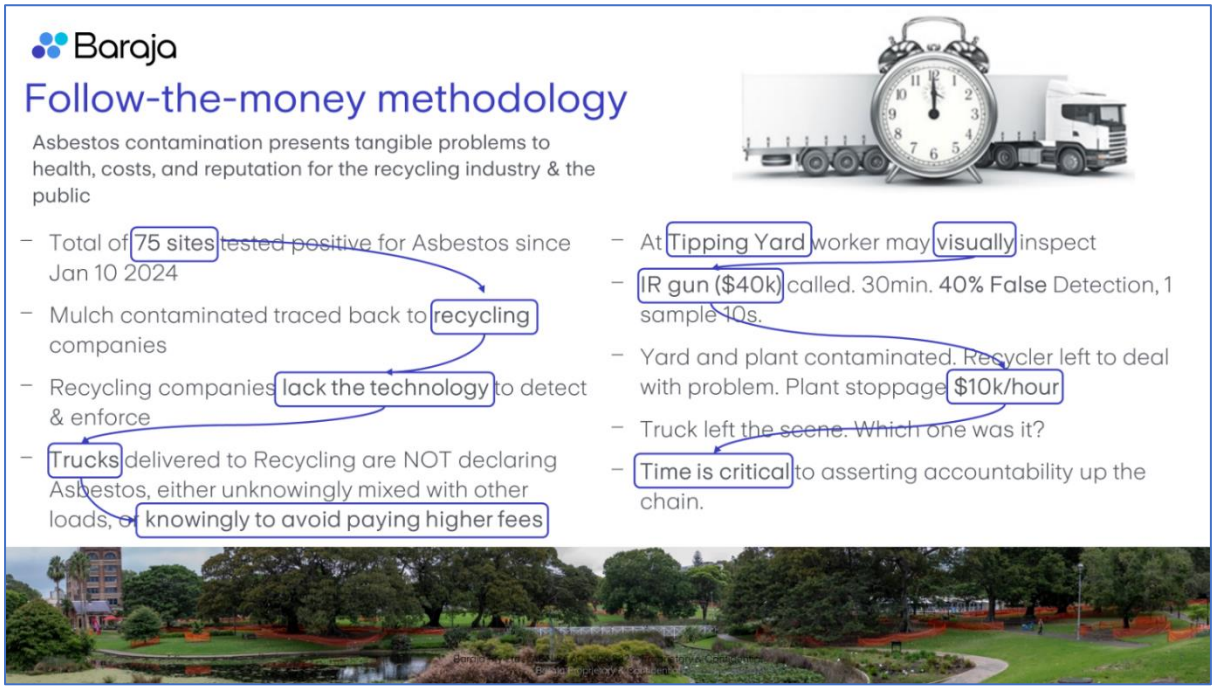
ii. what would be the limitations, costs or feasibility of safely removing asbestos in waste?

Limitations: In summary, the limit is the capacity of human operators in recycling plants to identify, in real-time, any asbestos materials while hundreds of tons of recycling waste is processed.

The problem is deeper than the appearance of "bad actors" in the mulch supply chain. Wood mulch is produced cheaply at recycling centres, which take construction waste of wood, concrete, metal and plastic, and sort each item into processing centres to reuse these materials in new products, for example, concrete aggregate, or notoriously recovered fines and wood mulch.

Once construction waste has arrived at a recycling centre, it is dumped on the tipping floor (or processing floor), and then it is the centres responsibility to meet the EPA guidelines on checking for ACM, which, at the moment, is to spread the load, and for a human operator to visually inspect for ACM. Fortunately, since ACM is from decades in the past, it has a distinct look and feel, thus humans are good at spotting it.

This human process is necessary because the only standard method for identifying ACM (AS4964-2004) requires to pick a sample and send to a laboratory, where it's microscopy tested to provide a qualitative assessment, which may take days and hence impractical for the real-time nature of the problem. Some of the centres have access to an infrared handheld meter, which, when placed in contact with the sample (one by one, takes 10s each), can provide a reading of ACM, though with a high rate of false negatives.



However, there are problems that prevent the effective detection of asbestos:

- There is no technology that can detect multiple pieces of ACM in situ, over the entire operational area (e.g. tipping yard).
- While a human operator is triggering an alarm and testing, they are not observing the rest of the materials in the tipping floor, creating an opportunity to miss materials.

- ACM may be (knowingly or unknowingly) “hidden” within the overall recyclable load and hard to spot, since disposal of asbestos is $500/tonne dearer than concrete (*1)

Costs:

Once the ACM leaves the tipping floor and enters the centre operations, it may be detected (e.g. conveyor and sorting systems), but it has already contaminated the plant and other waste, exposed workers. Moreover, the truck that brought the ACM is likely to have left the operations centre by then, and it is difficult to trace ACM to the particular truck that brought it. Our conversations with numerous recycling operators indicate **cost of stoppage** of a recycling centre operations would be as high as **$8-12k/hr**, and then would require cleaning of the line to prepare to start again.

Feasibility:

Thus, the critical point to detect and identify ACM is at the tipping floor, which is the last opportunity to remove it before it enters the plant, and before the offender leaves the centre. It is also mandatory point of access of ACM into the circular economy, so the return over investment of improved surveillance is maximised here.

- A key consideration for feasibility, is any solution will need to be real-time and be able to link the ACM found to whence it came, to adjudicate accountability up the supply value chain.

- Any screening solution needs to be hyper-parallel, able to simultaneously detect 10 - 100 pieces of asbestos material as they move onto the tipping floor.

An additional consideration, is the fact that currently, if ACM is found in the truckload and the truck is still present at site, the truck may decide to “take its business elsewhere”, basically another recycling or landfill facility where ACM is less likely to be detected. So, a key consideration in the feasibility of any solution will be either:

-- A similar solution is implemented everywhere “nowhere to hide” approach.

-- And/Or, enforcement powers such that the offending truck needs must dispose of the ACM immediately at closest facility that is able to accept ACM, paying the right fees.

-- Blacklisting notification going to other facilities and EPA if required.

-- A requirement to disclose (by the truck bringing in the ACM) the demolition site originating the ACM, would be useful in mapping the ACM all the way to its origin.

These actions propagate a message upstream that “you can’t get away hiding & dumping asbestos” to ultimately align incentives, change behaviours, for healthy communities.

Balancing Effectiveness and Accuracy:

Even the most accurate detection method/technology will be limited to detect what it can see/sample. So, in the case of laboratory tests or handheld guns (e.g. IR) that only scan one-by-one handheld samples that need to be pre-sighted by humans, you are sure to miss hundreds of ACM pieces that are hidden in the pile, if you miss it then it doesn’t matter how accurate you are, since your detection effectiveness will still be very low. Consider the following definition for detection effectiveness:

[1] https://www.bingoindustries.com.au/getmedia/e0f7ccba-fb90-4e35-b0d5-a8b6e76fc6f2/BINGO-B-D-New-Gate-Rates-from-1July23-NSW.pdf

Asbestos Detection Effectiveness = (Asbestos Samples Measured x Detection Accuracy) /Total Asbestos Present

So, as an example, a perfectly accurate technology (100%) that misses 50% of the asbestos present would only be 50% effective.

Our view is that effectiveness of the detection is key to detecting early on in the supply value chain (e.g. tipping yard).

Standards and guidelines for asbestos in waste

Question 7: Are there other standards or guidelines that would be applicable for managing asbestos in waste for beneficial reuse that can be provided?

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Question 8: Should the approach in the WA guideline (*Managing asbestos at construction and demolition waste recycling facilities*), be implemented in NSW and if so, why or why not?

i. Are there other factors that should be considered if the WA Guideline is to be implemented?

ii. Is there an alternative approach that could be considered?

Click or tap here to enter text.

Sampling and analysis

Question 9: Apart from AS4964 and ASC NEPM, are there other sampling and analysis methods for detecting and quantifying asbestos in waste materials or recycled products that are being received and processed at recycling facilities?

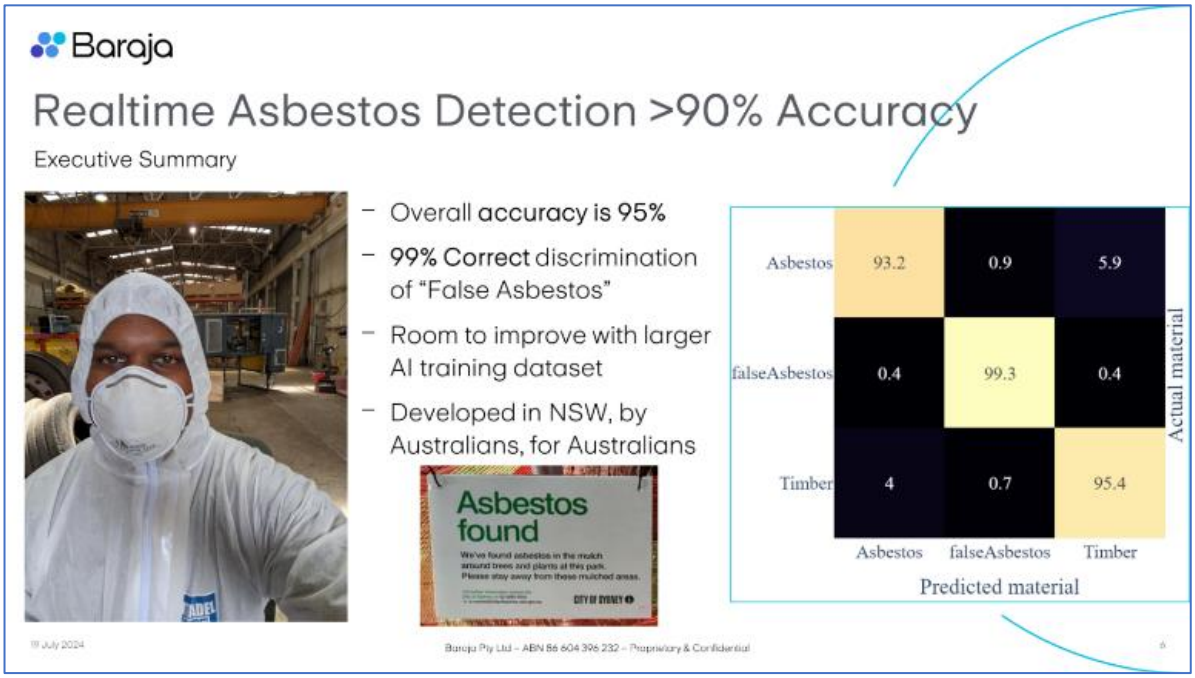
i. Are you aware of any other methods/processes for sampling and analysis of asbestos that the Review should consider? If so, please provide details and basis for their relevance to this Review.

ii. How reliable and accurate are these methods in ensuring that recycled waste is not contaminated?

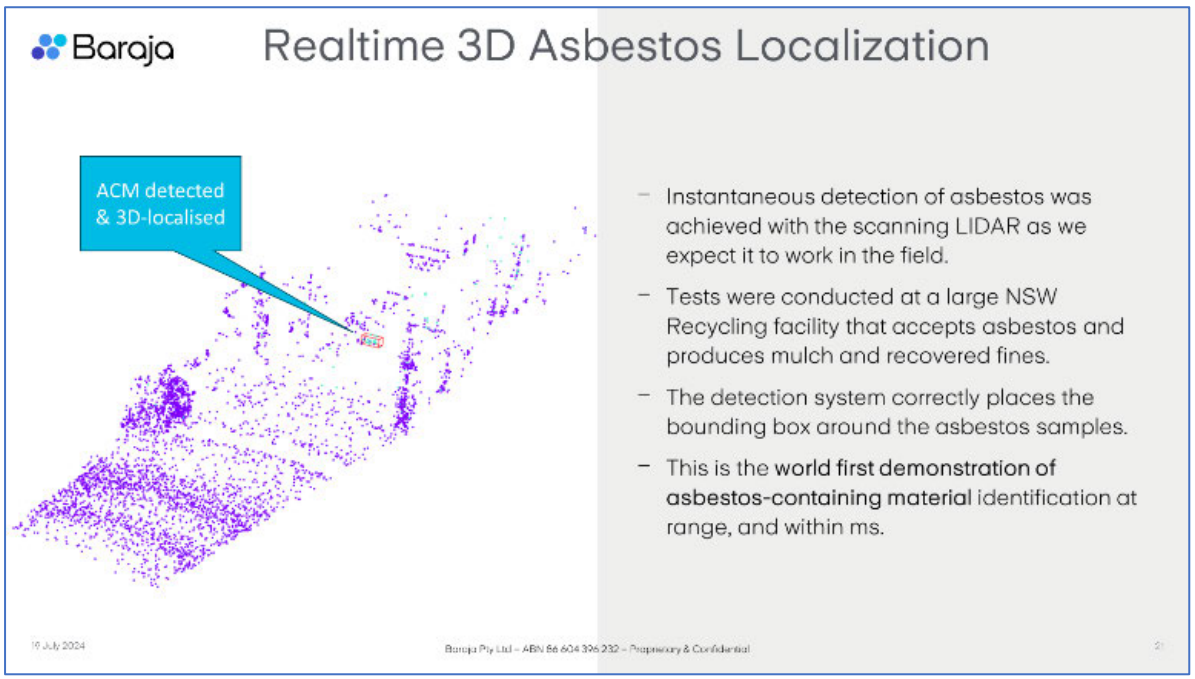
i. Are you aware of other methods/processes for sampling:

A new-to-world laser technology – developed in 2023 in Australia by Baraja – has demonstrated incredible efficacy & accuracy in detecting and 3D-localising ACM in real-time at long distances and over wide fields of view.

Results of asbestos detection to date, with real samples at recycling plants, show detection accuracy of >90%, with an autonomous alarm triggered and precise location of the contaminants on the tipping yard in real-time. Since the solution can perform millions of scans of the full tipping yard each second, the solution is highly effective and practical, enabling immediate corrective action, back to the offending truck, and immediate proper disposal of the asbestos to landfill, paying the correct dumping fee. This closes the loop of accountability real-time, and this accountability enforcement will travel upstream.



Using the previous definition of detection effectiveness, this technology solution is **highly effective at >90%.** It is also an automated quantitative method.



In contrast, AS4964 is a qualitative method, using polarized light microscopy (PLM). The standard itself (on page 2) acknowledges the following limitations (in italics):

(*a) PLM is a qualitative technique only.*

(b) It does not cover the identification of airborne and water-borne asbestos.

(c) Most samples of tremolite, actinolite and anthophyllite show a wide range of optical properties and can not be equivocally identified by PLM and dispersion staining.

(d) For valid asbestos identification there must be sufficient sample of the unknown fibres for them to exceed the practical detection limit of the technique used.

In addition, we identify the following limitations:

1. For any sample to be tested by AS4964, it must have been pre-identified visually by a spotter, collected, and sent for laboratory test.

2. Visual inspection by human spotter is made difficult by the fact that the ACM may be (unintentionally or intentionally) hidden within the load.

3. Human spotters suffer from visual and mental limited bandwidth to detect and they are looking for a variety of items (e.g. gas bottles, batteries, etc) not only ACM.

4. The turnaround time of lab tests would be several hours to days, which is impractical at the receiving side of the recycling operations.

Risk-based approaches for managing asbestos in waste

Question 10: Would a through-chain approach to managing asbestos in waste, where each business looks to minimise or eliminate the risk from asbestos in waste for beneficial reuse, work?

i. What elements would be part of the system/approach?
ii. What would be the advantages/disadvantages of such a system?

i. As discussed in this submission, we believe the key point of the through-chain is the tipping yard, and a technology that is highly effective at detecting ACM in large throughputs of waste, in an unstructured environment (e.g. not a conveyor belt, it is too late by then). The tipping yard is the point where Return On Investment of the increased surveillance is maximised.

Beyond the tipping yard, similar solutions could be deployed at the Demolition site, helping the early identification, containment and quantification of ACM.

Question 11: Are there other risk-based approaches to managing asbestos in waste for beneficial reuse?

Click or tap here to enter text.

General

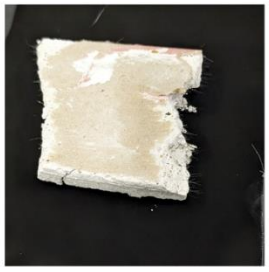
Question 12: Is there any further information you would like to provide the Review to assist us with in responding to the Terms of Reference?

In addition to industrially bonded asbestos containing materials, Baraja's laser technology is able to detect friable/ pure asbestos too and other materials highly relevant in recycling.

Baraja

Naturally Occurring Asbestos Samples

Drywall (non asbestos)



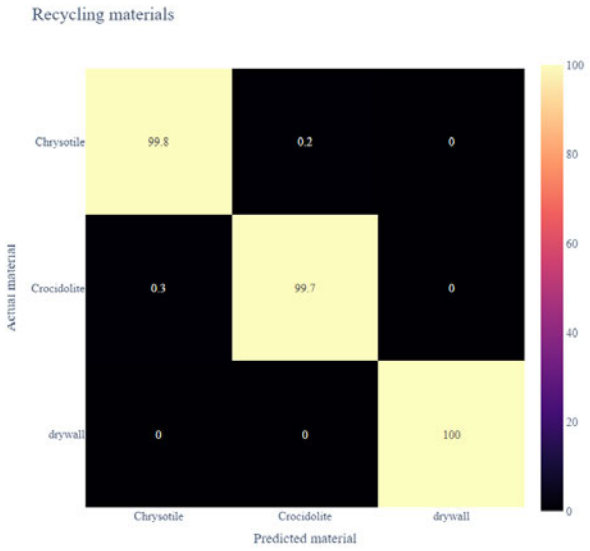
Crocidolite (a.k.a. blue asbestos)

Chrysotile (a.k.a. white asbestos)

There are 6 types of naturally occurring asbestos. Serpentine mineral **chrysotile** (also known as 'white asbestos'), and the five amphibole minerals – actinolite, amosite (also known as 'brown asbestos'), anthophyllite, **crocidolite** (also known as 'blue asbestos'), and tremolite (IARC, 1973; USGS, 2001)

Baraja

Naturally Occurring Asbestos: 99.8% accuracy



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Asbestos & Non-Asbestos Samples

Non-asbestos (drywall)

Asbestos (concrete board)

Asbestos (concrete board)

Asbestos (concrete board)

- Used near-IR handheld device to confirm; however, they have high false positive rates.
- The asbestos-containing materials were sheen on the faces, and powdery on the edges. They seemed to fit the description of concrete board – concrete powder sealed on both sides by fiberglass.
- To sample these materials, we measure the front, back and one edge. The feel of these sides is very different, so we suspect only the edge contains asbestos.

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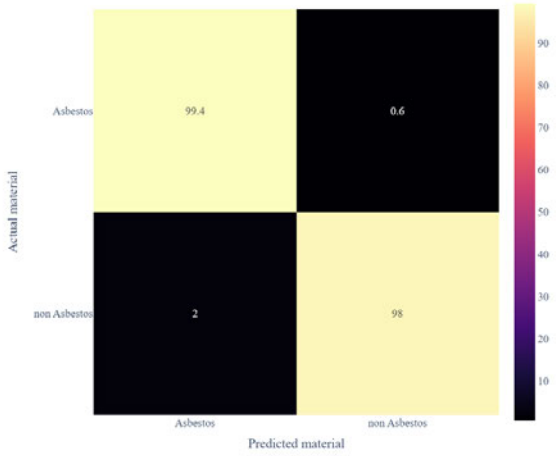
Bonded Asbestos:

99% accuracy



Baraja's technology is also able to avoid being thrown off by materials that to a human spotter look like ACM, but are not.

Baraja

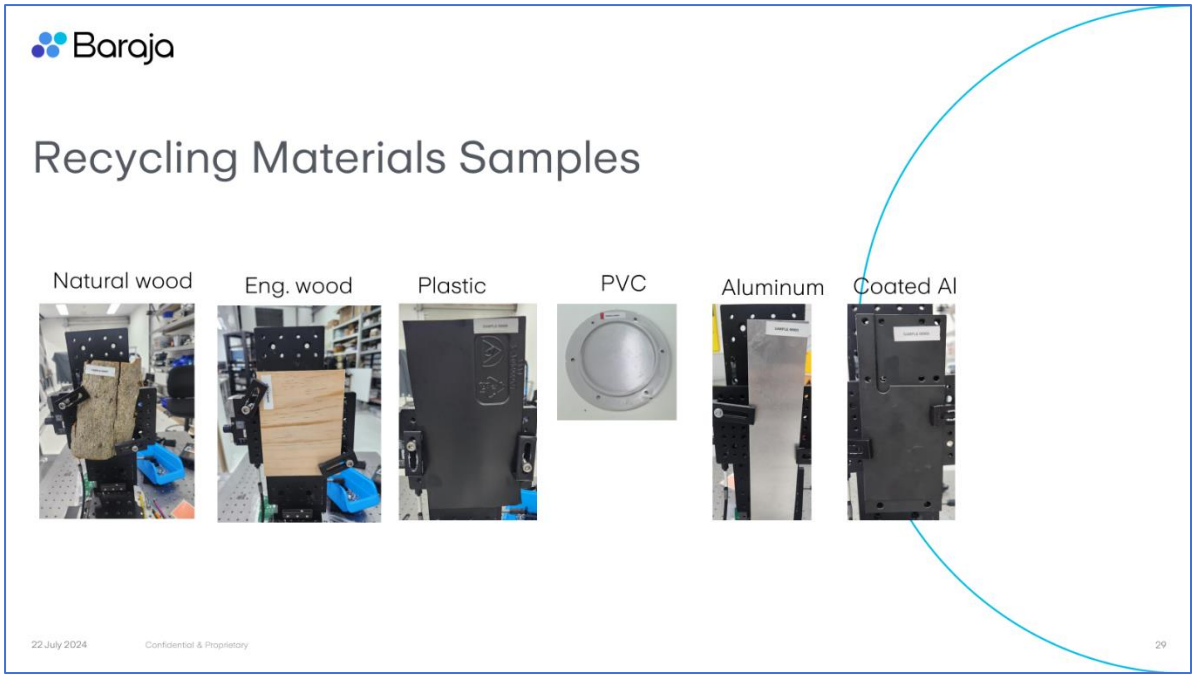
False asbestos materials

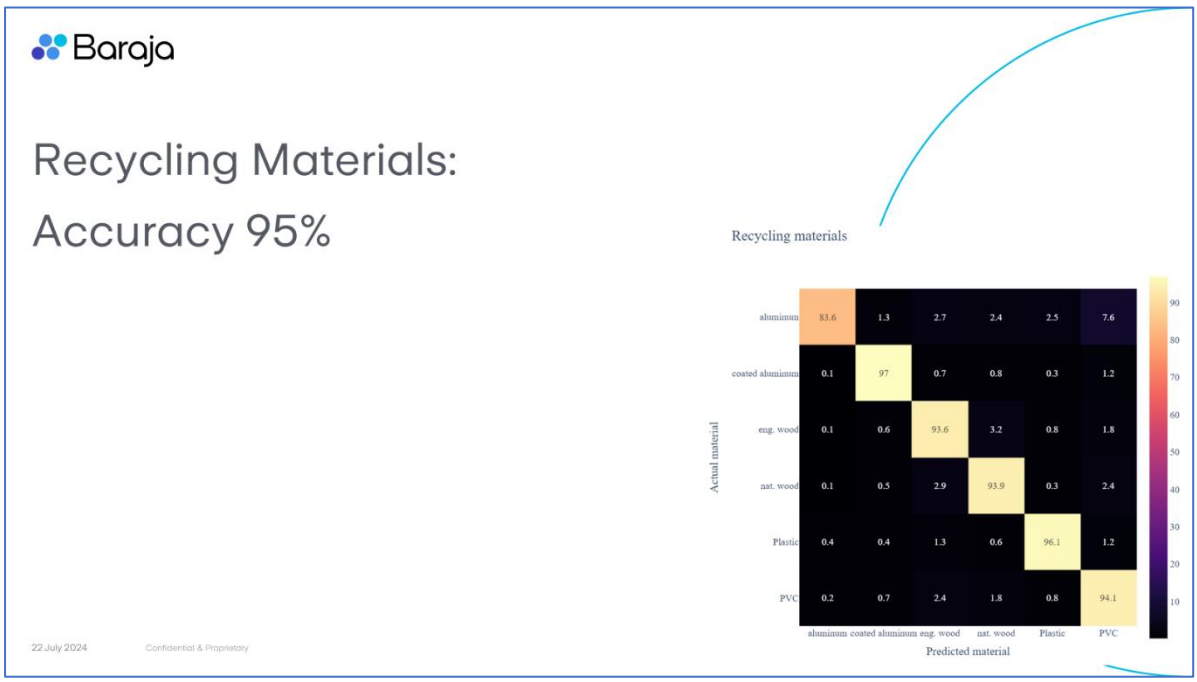
- The operators at Recyler gave us samples of fibre board that "look" like they have asbestos.
  - Full of powdery fiber, similar colored.
- However, these pieces always read negative for asbestos!
- We brought these samples back to the Baraja lab and tested them there.
- Our technology discriminated these from real asbestos with >99% accuracy.

Baraja

Recycling materials

These are a selection of relevant recycling materials:
- Black plastics (difficult to detect with current methods, e.g. hyperspectral)
- PVC (max. content of PVC on fuel must be lower than 10%)
- Ferrous vs non-ferrous metals
- Natural vs Engineered wood





More technical details of the laser scanner technology developed by Baraja can be provided upon request.

Email the completed form and attach any relevant data and information to asbestosreview@chiefscientist.nsw.gov.au by 31 July 2024.