URBIS

EVALUATION OF ASBESTOS MANAGEMENT AND REMOVAL OPTIONS

Report

Prepared for

ASBESTOS SAFETY AND ERADICATION AGENCY

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Urbis acknowledges the important contribution that Aboriginal and Torres Strait Islander people make in creating a strong and vibrant Australian society.

We acknowledge, in each of our offices, the Traditional Owners on whose land we stand.

Contents

Executive Summary

The past use of asbestos has left Australia with a devastating legacy of one of the highest rates of asbestos-related diseases (ARD) in the world. Asbestos is the greatest cause of work-related deaths in Australia. Over 4,000 Australians die prematurely from an ARD every year.

The Asbestos National Strategic Plan (ANSP) exists to eliminate ARDs in Australia. The Asbestos Safety and Eradication Agency (ASEA) coordinates the implementation of the ANSP. This socio-economic evaluation considers proactive asbestos removal options that will advance efforts to eliminate ARDs under the phase three ANSP.

ASEA and Urbis collaborated on an extensive overview of relevant literature (Chapter 2), followed by stakeholder consultation with government, industry, and independent experts to fill identified gaps (Chapter 4). Using this data and information, we evaluated costs and benefits of two options, compared to the status quo (Chapter 5). The options were:

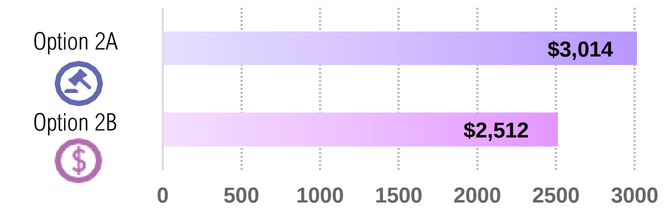
- Option 1 Status quo
- Option 2A Improved regulatory framework
- Option 2B Improved regulatory framework and government incentives

Results

Over 93% of all benefits gained with either Option 2A or 2B are due to health improvements. Government incentives for proactive asbestos removal result in the fastest reduction of ACM and greatest qualitative benefits. Improving the regulatory framework offers the greatest net benefit.

The total costs and benefits of options 2A and 2B, compared to Option 1, were discounted back to a Net Present Value (NPV) in 2023 dollars.

NPV, compared to Option 1 ($millions)



From this, the Benefit-Cost Ratio (BCR) was calculated, and the date by which all in-scope asbestos containing materials (ACMs) are expected to be removed was estimated.

Economic evaluation of options (discounted to 2023 dollars)

	Option 1	Option 2A	Option 2B
ACMs removed by (Year)	2100	2073	2068
Discounted costs	$0.00	$1,484.5m	$2,582.3m
Discounted benefits	$0.00	$4,498.5m	$5,094.2m
NPV	$0.00	$3,014.0m	$2,511.8m
BCR	1.00	3.03	1.97

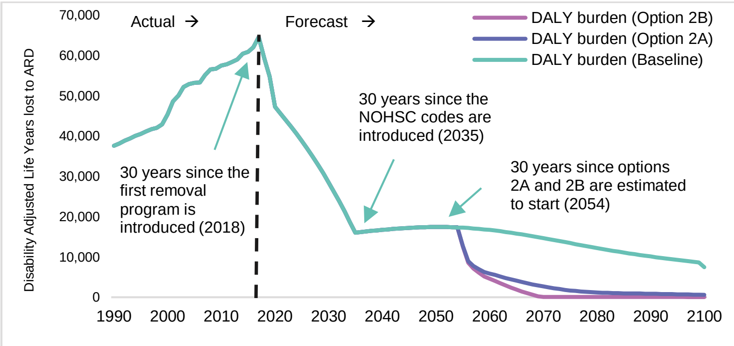
There are a range of significant benefits that could not be costed due to limited data, uncertainty, or intangibility. The socio-economic evaluation has nonetheless determined the impact of these benefits as low, moderate, high, or higher.

Qualitative Costs and Benefits

Costs	Option 2A	Option 2B
Government services costs, opportunity costs	Low	Low
Benefits		
Insurance premiums on property	Low	Low
Reduction in legal dispute costs and payouts	Low	Low
Improved productivity from a healthier population	High	Higher
Improved productivity and increase development activity	Medium	High
Comfort and peace of mind from national removal	Medium	High
Corporate reputation	Low	Low
Environment	High	Higher
Asset value	Medium	High

Human Health Impacts

The impact on, and cost of health burden was calculated using disability adjusted life years (DALY), which includes illness and premature death. The chart below shows an estimated impact of realising each of the options in terms of life years lost to disease burden (also in full size at **Figure 9** in Chapter 5).



The DALY burden is high. As ARDs reduce under the options so too do the associated health costs. In fact, health improvement is the most significant benefit of all measures evaluated, with a saving of $4.2 billion under Option 2A, and $4.8 billion under Option 2B discounted to 2023 dollars.

The health model in the socio-economic evaluation estimates that 24,943 premature deaths from ARDs could be prevented if Option 2A is implemented. This increases to 27,461 premature deaths from ARDs prevented under Option 2B.

Approximately 25,000–28,000 premature deaths from ARDs can be prevented. The inclusion of government incentives could prevent up to 10% more deaths than Option 2A.

Conclusion

This socio-economic evaluation provides a comprehensive evidence base for deciding on feasible options to reduce ARDs. While an improved regulatory framework (Option 2A) provides the greatest net benefit, decision makers will need to weigh this against the significant impact of lives saved, as well as other favourable human health and environmental impacts arising from the additional qualitative benefits afforded by including government incentives (Option 2B).

1. Introduction

The past use of asbestos has left Australia with a devastating legacy of one of the highest rates of asbestos-related diseases (ARDs) in the world. Asbestos is the single greatest cause of work-related deaths in Australia. Rates of ARDs have not declined as expected following improvement of asbestos management and removal approaches over the last 35 years. Approximately 4,000 Australians still die each year from past occupational and non-occupational exposure to asbestos. This is around three times higher than the national road toll.

The Asbestos Safety and Eradication Agency (ASEA) was established in 2013 to encourage, coordinate, monitor and report on implementation of a national strategic plan for asbestos awareness and management which aims:

> *To prevent exposure to asbestos fibres in order to eliminate ARDs in Australia.*

The Asbestos National Strategic Plan (ANSP) ensures governments are working cooperatively to prevent exposure to asbestos fibres in homes, workplaces and the environment. It provides a long-term phased approach to eliminate asbestos-related diseases in Australia. Phase one of the plan covered 2014–2018. The plan is now in phase two, which will end in 2023. The next phase (phase three) will consider how to remove ACMs from the environment in a sustainable and safe way.

Increasing the rate of ACM removal is necessary now because:

- disease rates show an estimated 54,750 Disability Adjusted Life Years (DALY) lost to ARDs in 2019 alone
- around 6.2 million tonnes of asbestos-containing materials (ACMs) remain in our built environment, more than half of this is estimated to be in our homes
- ACMs have reached end of product life and are degrading, increasing the risk of exposure to asbestos fibres
- climate change and the escalating frequency and intensity of extreme weather and other disaster events in Australia is increasing the risk of exposure to asbestos fibres as ACMs become damaged and disturbed during these events; making subsequent clean-up more dangerous, time-consuming, and costly.

ASEA engaged and collaborated with Urbis to evaluate the societal and economic costs and benefits of actions proposed for inclusion in the phase three ANSP. The socio-economic evaluation used a cost-benefit analysis (CBA) to provide an evidence base for decision makers by determining:

> *To what extent a shift in policy from in situ ACM management to more proactive management and removal, consistent with the hierarchy of control, would provide a net benefit to Australians?*

Proposed actions for the phase three ANSP, focussed on improved asbestos risk control and increased safe proactive ACM removal in Australia, were grouped into the following options:

- **Option 1 – The status quo**
  This option establishes a baseline for comparison to other options being considered. It evaluates the continuation of the existing policy and regulatory framework for the managing, removing and disposal of ACMs. The current ACM management approach, representing Option 1 or the 'baseline', was modelled using the most recent stocks and flows estimates.
- **Option 2A – Improved regulatory framework**
  This option proposes improvements to the existing regulatory framework for managing, removing, and disposing of ACMs, to safely increase the rate of ACM removal based on risk. Various regulatory and non-regulatory amendments are considered, such as training, disclosure improvements and improving proactive enforcement and compliance activities. This option assumes one or more of these proposals will be incorporated into the phase three ANSP and subsequently adopted in all jurisdictions.
- **Option 2B – Improved regulatory framework and government incentives**
  Option 2B builds on the proposal under Option 2A by including government incentives to further increase the rate of safe and proactive removal from commercial and residential properties, and to create value in the economy via improvements to public wellbeing, economic cost savings and other non-quantified improvements.

The options evolved during the evaluation in response to stakeholder feedback. The full options, including the proposed activities under each, are in Chapter 3.

The evaluation uses a cost-benefit analysis (CBA) to estimate the impacts of ACM in government, commercial and residential property. It compares costs and benefits associated with the current management and removal approach in Australia, to a situation where ACMs are being removed from the built environment at an increased rate. The impact of the options was considered for all affected people, including any impact on human health, business and industry, workers, homeowners, disposal facilities and governments.

The methodology and framework for evaluating the options were discussed with appropriate stakeholders and adjusted where needed. For example, adjustments to the asbestos stocks and flows estimates under options 2A and 2B have been made based on the literature review and stakeholder consultation, to ensure the increased rates of ACM removal induced by these options are realistic and feasible.

Our approach has been conservative, using definitive data where available, or median costs and lower-end benefits where assumptions have been necessary. This ensures the robustness of the analysis and the ability of the modelling to provide complete, accurate and realistic results. This is borne out through sensitivity testing which applies lower and higher values to key assumptions to ensure the model operates as planned.

This report will be provided to relevant ministers to inform their decision on the actions to be included in the phase three ANSP, to best advance the aim of eliminating ARDs in Australia.

2. Overview of Research Literature

We have conducted an overview of research and other literature on the regulatory environment for the management and removal of ACMs; the risk of exposure; and policy, practice and technical developments in Australia and internationally.

Consistent with the scope of this evaluation, the following topics were excluded from the literature review: naturally occurring asbestos; mining; asbestos cement water and sewage pipes; asbestos in vehicles and maritime vessels; and unlawfully imported goods containing asbestos.

Therefore, this was not intended to be a comprehensive or systematic literature review and did not draw conclusions on the entire body of research about asbestos and ARDs. Rather, it drew out some key findings from the literature relevant to conducting this evaluation. The identified costs and benefits in the review were used to undertake a benefit-cost analysis of the options. Where gaps in costs and benefits were identified in the literature review, stakeholder consultation was carried out to fill the gaps.

2.1 Methodology

ASEA compiled a list of documents at the start of this literature review. These documents were reviewed alongside other data sources found using search engines, including Google and Google Scholar. Australian and international government, corporate and research organisation websites were also examined.

The resulting literature selected for this review includes academic literature, grey literature (i.e. material and research not commercially published) and internet resources. Keywords to guide the search were informed by topics identified by ASEA. These topics included the history of asbestos, asbestos risk, asbestos exposure, impacts of regulation, compliance costs and policy developments.

Priority was given to sources published in the last 5 years. However, a small number of older sources were included where still relevant. This included sources that relate to legislation that currently stands and sources that provide important information where newer sources are unavailable.

2.2 History of asbestos use in Australia

Asbestos is a group of six types of naturally occurring, rock-forming silicate minerals made up of thin, microscopic fibres or a mixture that contains one or more of those minerals (NICNAS 1999: 3). The main type used in Australia was chrysotile asbestos from the serpentine group; however, amosite and crocidolite from the amphibole group were also used (NICNAS 1999: 5).

Asbestos was first imported to Australia in 1893, and asbestos cement products were imported from around 1903 (ASEA 2022a: 11). ACMs were first manufactured in Australia around 1916–17 (ASEA 2022a; OCTIEF 2018). Leading up to the cease of asbestos use in Australia, primary local ACM manufacturers included James Hardie, Goliath Portland Cement Co, The Colonial Sugar Refining Co (CSR) and Wunderlich Ltd (The Australian Asbestos Network 2023; ABC News 2010). There were dozens of imported products under a range of brand and product names.

The 2 leading manufacturers were James Hardie and Wunderlich. Up until the 1960s, 25% of all new housing in Australia was clad in asbestos cement sheeting (Leigh and Driscoll 2003, in ASEA 2017a: 22). Consumption peaked in 1975, then decreased rapidly until the early 1980s, where it remained at very low levels until its eventual total ban in 2003 (Brown et al. 2023: 1).

2.2.1 Phased ban of asbestos in Australia

Following increasing public awareness of the carcinogenic nature of asbestos fibres, a phased ban of asbestos took place in Australia (ASEA 2017a: 8).

All asbestos mining in Australia was stopped by 1983 (NICNAS 1999: 3). Unpublished minute papers from the Commonwealth Department of Housing and Construction note use of asbestos-containing products was limited in Australian Government construction projects from 1974. Bans on the use of crocidolite and amosite asbestos were progressively put in place across Australia from the late 1970s onwards.

The May 2001 meeting of the former Workplace Relations Ministers' Council (WRMC) agreed to the imposition of a ban on the import and use of chrysotile asbestos no later than 31 December 2003 (Parliament of Australia: 2001). This Australia-wide ban was enacted through the work health and safety (WHS) laws in each jurisdiction and is supported by a prohibition on the import and export of goods containing asbestos and ACMs under the Commonwealth Customs (Prohibited Imports) Regulations 1956 and the Customs (Prohibited Exports) Regulations 1958 and the Customs Regulations 2015. The 2003 ban did not extend to ACMs already in place at the time it took effect (ASEA 2017: 6).

2.2.2 Legacy asbestos stocks and flow

Because the bans that were imposed did not apply to ACMs already in place (in situ asbestos), significant amounts of legacy ACMs remain in public and commercial buildings, homes and infrastructure (ASEA 2017a: 6).

After peaking in 1980 at around 11 million tonnes, ACM stocks are predicted to decline at just above 10% per decade. This means that without significant intervention, ACM stocks will decline to around 1 million tonnes by 2060 (Brown et al. 2023). In 2021 it was estimated that 6.2 million tonnes of ACM stocks remain in Australia's built environment (Brown et al. 2023:1), made up of 3.4 million tonnes in asbestos cement pipes, 1.5 million tonnes in domestic asbestos cement sheeting, and 1 million tonnes in commercial asbestos cement sheeting (Brown et al. 2023: 5). The projected quantity of ACM stocks for 2030 is 4.9 million tonnes at the existing probability of removal rates (Brown et al. 2023: 5).

The *Hazardous Waste in Australia 2021* report notes Australia's two largest hazardous waste streams are contaminated soils and asbestos; it is estimated about 21% of Australia's hazardous waste is asbestos (Latimer 2021: 14). Asbestos waste has increased nationally from approximately 315,000 tonnes in 2006–07 to 1.1 million tonnes in 2021–22. Most asbestos waste comes from renovation and urban development, and all goes to landfill. Peak flows of ACM to waste are estimated for 2030 to be at around 167,000 tonnes (range 145,000 to 185,000 tonnes; Brown et al. 2023), which is lower than reported asbestos waste because the stocks and flows estimations do not consider asbestos-contaminated soil and rubble (Brown et al. 2023: 7).

2.3 Asbestos risk

2.3.1 Potential for asbestos exposure

Due to the extensive ACM stocks that remain in the built environment, the risks of exposure to asbestos fibres in both the workplace and non-workplace settings remains. Preventing exposure requires ACMs to be accurately identified and then maintained in a stable state until they can be safely removed (Safe Work Australia 2020b). ACMs in Australian buildings are anywhere between 30 to100 years old. This age means that ACMs are starting to degrade, increasing the risk of becoming friable and releasing asbestos fibres (ASEA 2022a: 12-13). In addition, the increasing frequency of extreme weather and other disaster events can disturb ACMs before safe removal has occurred (Quezada et al. 2018).

2.3.2 Contemporary asbestos exposure risks

Historically, the most significant source of workplace exposure was from asbestos mining and manufacturing (AIHW 2021a: 11). These types of exposures resulted in what is known as the 'first wave' of ARDs; with the 'second wave' of ARDs arising due to working with and using asbestos products and historical practices (Armstrong and Driscoll, 2016). The presence of asbestos in millions of homes, public and commercial buildings across Australia today means workers at the greatest risk of exposure now are those who undertake removal, repairs, maintenance, renovations and other work on structures built before 1990. This presents a risk of a 'third wave' of exposures (Mahoney et al. 2023), and workers at risk include builders, electricians, plumbers and painters (Khatib et al. 2023a).

Past non-workplace exposures arose from living with an asbestos worker or living near an asbestos mine or factory. These exposures have consistently been associated with disease (Khatib et al. 2023a). However, because of progressive bans, these exposures have become less common. Home improvers and renovators are now the most likely at-risk group for non-workplace exposure since they have little or no training in asbestos handling and removal and are less likely to adopt protective control measures to minimise exposure (Khatib et al. 2023a).

Indigenous communities, particularly in Western Australia, NSW and Northern Territory, have large amounts of in situ ACMs, mostly in poor condition (Gray et al. 2016: 296). These locations are also prone to extreme weather, which can damage the ACMs further (Gray et al. 2016: 296). Gray's study also found that social housing contained large amounts of in situ ACMs (Gray et al. 2016).

Data collected from the Australian Mesothelioma Registry covering 2010–2021 found 12.2% of people on the registry who completed an optional exposure assessment experienced occupational exposure only, 35.8% experienced non-occupational exposure only, and 52% experienced both occupational and non-occupational exposure (Walker-Bone et al. 2023). It should be emphasised that the exposure assessment is optional, with approximately 15% of those on the registry participating (AIHW 2019). Voluntary participation in the asbestos exposure assessment has the potential to create bias in the data. In addition, most of the information available about asbestos exposure currently relates to past occupational exposures, and there is a lack of information about non-occupational exposures (ASEA 2022a).

According to research from the World Health Organization's (WHO) Collaborating Centre for Elimination of Asbestos-Related Diseases at the Asbestos Diseases Research Institute (ADRI), mesothelioma incidence among males is generally considered a good indicator of past occupational asbestos exposure (Lin 2021). When the male-to-female incidence ratio for mesothelioma approaches one, non-occupational or environmental exposure plays a more important role (Alpert et al. 2020: 35-36). In one study, the population-attributable risk for occupational asbestos exposure was 83.1% for men and 41.7% for women, whereas non-occupational asbestos exposure was 20.0% in men and 38.7% in women (Lacourt et al. 2014). There is strong evidence that low levels of asbestos exposure contribute to carcinogenesis (van der Bij S et al. 2013 in van Zanwijk et al. 2019).

2.4 Health and environmental impacts

2.4.1 Health impacts

Physical disease

All forms of asbestos cause cancer and several other life-threatening ARDs (IARC 2012). According to the most recent Global Burden of Disease (GBD) 2020 study, 4,449 Australians died from ARDs in 2019. Under a worst-case scenario it is projected the number of deaths will be 7,312 in 2040 – determined using the available GBD data visualisation tools (IHME 2020). The 2019 deaths are attributed to past occupational asbestos exposure, although a small proportion of them probably arose from non-occupational exposure, since non-occupational exposure was not separately reported (ASEA 2023a).

In 2019, Australia's death rate from ARDs was around 18 deaths per 100,000 of the population with 30 deaths per 100,000 for men and 7 deaths per 100,000 for women (ASEA 2022b). Based on the results from the GBD 2020 study, this was the twelfth highest death rate from ARDs among the 64 World Bank High-Income Countries.

Asbestos is the only cause of asbestosis and is the predominant cause of mesothelioma (IARC 2012 in Mahoney et al. 2023). Cancer of the lung, larynx and ovary is more commonly caused by other carcinogenic agents in addition to asbestos (ASEA 2022a: 19). Smoking has a synergistic, multiplicative effect on the lung cancer risk resulting from exposure to asbestos (Klebe et al. 2020). The majority of the 4,449 deaths (i.e. 3,307) were from lung cancer (ASEA 2022b: 15).

In 2021, 701 deaths from mesothelioma were recorded by the Australian Mesothelioma Registry (AIHW 2023a). On average, the rates for surviving at least 5 years after diagnosis of mesothelioma and lung cancer are less than one in 5 (ASEA 2022b: 14), and the median survival for people diagnosed with mesothelioma is just one year (ASEA 2022b: 14).

In 2015, there were 62 asbestosis deaths in Australia (ASEA 2017a: 29). Treatment for asbestosis can slow the condition, but it cannot cure it (ASEA 2022b: 14).

Quantifying the impact of asbestos-related diseases

ARDs result in a significant burden of disease both worldwide and within Australia.

ARDs present a high cost to the Australian health care system, with the direct health system costs estimated at $192 million in 2015 (CIE, 2018). In the 2019–20 financial year, the estimated health system expenditure for mesothelioma was $32 million and $16 million for asbestosis (AIHW 2021b). The indirect costs to the workforce and broader economy were estimated at $321 million in 2015 (CIE, 2018). Data is available on the costs of lung and other cancers to the health system. However, it is difficult to estimate what proportion of cancer cases are attributable to asbestos exposure.

Globally, the forecast for years of life lost (YLL) from asbestosis in 2040 is approximately 101,500 and currently is at around 61,000 (Foreman et al. 2018: 2069). In Australia, the Australian Institute of Health and Welfare (AIHW) found that in 2022, cancers were the group of diseases causing the greatest burden (AIHW 2022). Mesothelioma had a disability adjusted life years (DALY) measure of 11,292, equivalent to 0.34 per

1,000 population (AIHW 2022). For asbestosis in Australia in 2022, there were 1,444 DALY, with a fatal burden of 1,337 YLL and 106.7 years lived with disability (YLD; AIHW 2022).

Psychological disorders

Studies have documented the psychological disorders that can develop because of a diagnosis of an ARD (e.g. Sherborne et al. 2020). However, even in the absence of any documented disease, people exposed to asbestos can suffer from significant psychological distress (ASEA 2021a: 10). For example, a study looking at the levels of psychological strain in German workers previously exposed to asbestos found that affected individuals are more prone to intrusive thoughts and specific fear of asbestos-related cancer (Lang 2019). On an individual level, asbestos exposure can lead to social isolation and a lack of social support (Buultjens et al. 2015).

Time between exposure and asbestos-related diseases onset

Examination of existing public health literature places the average delay between exposure to asbestos and the onset of an ARD between 20 and 40 years (CIE, 2018; Mahoney et al. 2023). Health impacts related to asbestos exposure that are present today therefore relate to exposure events occurring as far back as the 1980s or earlier. Since this time, significant changes have occurred to the regulation and policy that impact health outcomes. These include ACMs being made an illegal building and import material, ACMs being designated as a hazardous waste material, and improved understanding of the negative health impacts of asbestos exposure.

Overall, this means that the nature and impact to health from exposure to asbestos has changed. Notably, the nature of exposure has shifted from occupational to non-occupational settings, and from significant short-term exposure events, to long-term, low dosage exposure, primarily in residential settings (Mahoney et al. 2023). As a result, it is anticipated that the link between ACM removal and disposal to ARD incidence is less pronounced in the present day. However, there is no conclusive evidence to suggest the extent to which health impacts are mitigated under the current policy and regulatory framework.

2.4.2 Environmental impacts

Environmental impacts of asbestos include contamination of soil, water and air. Unlawful activities, past land use practices, natural weathering, disasters, and activities such as renovation and removal can result in both short-term higher-level exposure risks and long-term low-level exposures (Khatib et al. 2023a: 16; VAEA 2022). For example:

- High-pressure cleaning of the ACMs can result in widespread contamination, including of neighbouring properties (OWHSP 2023).
- Illegal disposal of asbestos is a risk to public health and the environment. Perceived cost and convenience are drivers of illegal asbestos disposal (NSW EPA 2021b). For example, lack of disposal options within a close travel time has been linked to the illegal disposal of asbestos in Victoria (Sustainability Victoria 2021). In NSW, it is estimated that asbestos accounts for up to 8% of illegally dumped waste (NSW EPA 2020a). While data on the costs of illegal asbestos disposal is varied and incomplete, it is estimated to be costly. For example, a single incident of illegal waste dumping on Hazeldean Road, Ellinbank, that included asbestos in the Baw Baw Shire Council (Victoria) cost ratepayers $32,345 to remediate the contaminated area (Baw Baw Shire Council 2022).
- Fifty sites contaminated with legacy asbestos in the soil or surrounding land have been identified by the NSW EPA and other NSW government agencies in 2022 (City of Parramatta 2022). In addition, there are known cases of waste companies selling or giving away asbestos-contaminated soil as ‘guaranteed clean’ or ‘certified’ (NSW EPA 2020b).
- Industrial disasters like the Wool Store Fire in Wickham, Newcastle, where asbestos debris became airborne and spread to Wickham and nearby suburbs. It was reported that 392 people had registered as being affected, and of those registered, 200 properties had been assessed as requiring environmental cleaning (Cox L, 2022).
- Disasters and extreme weather conditions can heighten asbestos exposure risks (Quezada et al. 2018: 8). Bushfires in 2022 in the Australian town of Corrigin, for example, led to the ‘shattering’ of asbestos contained in homes destroyed by the fires (Mackintosh 2022). Instances such as this can be very costly to a community; in this case, individuals were quoted up to $250,000 to remove the asbestos from their buildings (Mackintosh 2022). Similarly, in the town of Kalbarri in 2021, 25% of all buildings impacted by a cyclone were found to contain asbestos (Parry and Christmas 2021). This is not only dangerous for the

residents of the individual homes but for the community also, as loose fibres can become airborne once released (Parry and Christmas 2021).

Climate risk

The Black Summer bushfires of 2019–2020, Cyclone Seroja in Western Australia in 2021 and flooding events in NSW, Victoria, South Australia, Western Australia and Queensland in 2022 and 2023 highlight the continued potential asbestos exposure ramifications and additional costs that can arise from the failure to remove identified asbestos. The broader social and economic impacts and costs, already in the billions of dollars, are likely to increase in future as disasters and extreme weather increase in frequency and/or severity due to climate change (BOM and CSIRO 2022; CSIRO n.d.; Pörtner et al. 2022).

A risk assessment looking at the impact of climate change on Australia's built environment found that, of the 15 million addresses in 544 local government areas, approximately 383,300 were considered high risk in 2020 (Mallon et al. 2019). This number is projected to increase to 735,654 addresses in 2100 for existing structures only (Mallon et al. 2019: 5). Events used to determine risk levels included likelihood of being substantively impacted by one or more of the following: riverine flooding, costal inundation, forest fire, subsidence (caused by drought) and high wind (excluding cyclones) (Mallon et al. 2019).

A report by the Commonwealth Scientific and Industrial Research Organisation's (CSIRO) Data 61 found that climate change may increase the rate of deterioration of ACMs and consequently may bring forward the transition of ACMs into the waste stream (Quezada et al. 2018). It also found that workers including volunteers conducting post-disaster clean up are at high risk of exposure due to damaged and friable ACMs (Quezada et al. 2018).

Environmental sustainability and financial reporting

Environmental, social and governance (ESG) is a framework that allows stakeholders and investors to understand how an organisation is managing risks and opportunities (Gaganis et al. 2021). While there is no formal definition of ESG, it typically refers to a collection of corporate performance criteria that assess the robustness of a company's governance mechanisms and its ability to manage its environmental and social impacts (Gartner n.d.).

Importantly, ESG captures diverse non-financial risks that can materially affect an organisation's financial performance, such as the risk of fines or prosecutions, consumers choosing alternative products or services with greater worker diversity and better labour conditions or that are more environmentally friendly (Deloitte. N.d). It is increasingly used to inform investment decisions (Deloitte. N.d), is mandatory in 29 countries (Yu 2023), and is widely applied on a voluntarily basis in Australia (Longo 2023).

The Australian Government has recently consulted on amendments to the *Australian Securities and Investment Commission Act 2001* that would empower the Australian Accounting Standards Board to design and implement standardised, internationally aligned requirements for disclosure of sustainability risks and opportunities in Australia, starting with climate risks (The Treasury 2022).

The Global Reporting Initiatives (GRI) Standards reflect global best practice for ESG reporting, helping organisations respond to emerging information in sustainability reporting (GRI 2023). The *Global Standard 403: Occupational Health and Safety 2018* includes various disclosures that are relevant to reporting ACMs in the workplace. These include Disclosure 403-1, which requires reporting in relation to an occupational health and safety management system, Disclosure 403-2, which requires reporting in relation to hazard identification, risk assessment and incident investigation, and Disclosure 403-5, which requires reporting in relation to occupational health and safety training for workers (GSSB 2018: 9,10,13).

McGregor et al. (2021: 307) found that liabilities related to asbestos are likely to meet the materiality criterion for disclosure in financial statements and should be addressed there, even if separately addressed in sustainability or annual reports. They found that both public and private entities are failing to recognise or appropriately measure liabilities related to asbestos and that the implications for assets and expenses in financial statements are rarely reported (McGregor et al. 2021: 307). Implications for valuations include, for example, assessment costs, civil suits, legal fees or costs of removal (McGregor et al. 2021: 310-311). Proper disclosure of asbestos-related liabilities is needed to ensure financial statements are an accurate reflection of the entity's financial position (McGregor et al. 2021: 316). Entities are required to manage material risks because they impact stakeholder decisions (McGregor et al. 2021: 307). Due to the increasing implications of climate change, material risks in the financial sector are being further scrutinised (McGregor et al. 2021: 307).

2.5 Asbestos regulation in Australia

The regulation of asbestos in Australia involves governments at all levels, across a range of areas within government. It is also spread across all three tiers of government at the local, state/territory and federal levels.

This results in a network of laws across a range of areas, including WHS, public health, environment protection, dangerous goods, border protection, consumer safety and urban planning that prohibit asbestos and regulate asbestos management, removal and disposal in both the workplace and non-workplace settings.

In 2012, the Asbestos Management Review identified that the management of asbestos across multiple jurisdictions was fragmented and inconsistent. The review found that urgent, systematic, nationwide action was needed to deal with Australia’s asbestos legacy and that a national strategic plan would be an appropriate tool to focus and coordinate asbestos-related actions across Australia (Asbestos Management Review 2012). The review made recommendations on key elements of a national strategic plan and the establishment of a new national agency to administer it. ASEA was subsequently set up in 2013 to encourage, coordinate, monitor and report on the implementation of the Asbestos National Strategic Plan as its central function (Asbestos Management Review 2012).

The Asbestos National Strategic Plan establishes a framework for all levels of government to work cooperatively in the areas of asbestos awareness, management, removal and disposal. It outlines a phased approach to eliminate ARDs in Australia and recognises Australia’s international role in leading the campaign for a worldwide asbestos ban.

2.5.1 Workplace health and safety

The risks of exposure to ACMs in the built environment are mainly managed and controlled under jurisdictional WHS laws. Since the 1970s, numerous acts, regulations, codes of practice and guidance material have been introduced to control asbestos exposures in the workplace.

In 1988, the National Occupational Health and Safety Commission (NOHSC) released its first asbestos regulatory guidance materials – the *Guide to the Control of Asbestos Hazards in Buildings and Structures [NOHSC:3002 (1988)]*; *Code of Practice for the Safe Removal of Asbestos [NOHSC:2002(1988)]* and *Guidance Note on the Membrane Filter Method For Estimating Airborne Asbestos Dust [NOHSC:3003(1988)]* (NOHSC 1988).

The Code of Practice for the Safe Removal of Asbestos was directed at specific removal jobs such as those involving the removal of the sprayed asbestos coatings used for thermal and acoustic insulation and limited guidance was provided on work involving asbestos cement (fibro) products and floor tiles containing asbestos. In 2005, after the complete asbestos ban in 2003, NOHSC released the forerunners to the present day codes of practice – *Revised Code of Practice for the Safe Removal of Asbestos [NOHSC:2002(2005)], Code of Practice for the Management and Control of Asbestos in Workplaces [NOHSC:2018 (2005)]* and updated *Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres [NOHSC: 3003(2005)]* (NOHSC 2005a, 2005b, 2005c). These complemented the revised national exposure standard for chrysotile asbestos and provided for the first time a comprehensive nationally consistent approach to safe management and removal of ACMs.

This nationally consistent approach was further enhanced by the publication of the model WHS laws in 2011 by Australia’s national policy body for WHS and Workers’ Compensation – Safe Work Australia (Safe Work Australia 2011b). All jurisdictions except Victoria have implemented the model WHS laws, and some jurisdictions have made minor variations (Safe Work Australia 2011b). For example, ACT has additional requirements related to asbestos awareness training, asbestos assessments and unlicensed asbestos removal (ASEA 2021b: 12-13). The ACT supplemented the model WHS laws due to concerns that standards under the model would be lower than those applying in the ACT at the time (Safe Work Australia 2011 p. 24).

The model WHS regulations contains a detailed chapter that includes both general and specific duties to manage and control asbestos in the workplace (Safe Work Australia 2023). The model WHS regulations require a person conducting a business or undertaking (PCBU) to ensure that exposure of people at the workplace to airborne asbestos is eliminated or, if elimination is not reasonably practicable, exposure is minimised so far as is reasonably practicable, and that the workplace exposure standard (WES) for asbestos is not exceeded (Safe Work Australia 2023: 295). The current WES for asbestos is a respirable fibre level of 0.1 fibres/mL (0.1 f/mL, equivalent to 0.1 f/cm^3) of air measured in a person’s breathing zone and expressed as a time-weighted average fibre concentration calculated over an 8-hour working day (ANU 2022: 34). For air monitoring related to the removal of friable asbestos, a limit of 0.01 f/mL of also applies, whereby work cannot resume until air monitoring shows that the recorded respirable asbestos fibre level is below that threshold (Safe Work Australia 2020a: 27-28).

As the WHO states, asbestos does not have a safe exposure level, which means that any exposure to asbestos may eventually lead to disease. Because it is not possible to set a health-based occupational exposure limit (OEL), a relationship between exposure levels and the associated risk (exposure–risk relationship – EER) is derived instead. This expresses the excess risk of lung cancer and mesothelioma mortality (combined) as a function of the asbestos fibre concentration in the air, to facilitate the setting of an OEL. The excess lifetime cancer risk represents the risk of death from cancer more than the 'natural' background risk, resulting from a lifetime exposure to the carcinogen. The current asbestos OEL is 0.1 f/cm^3, based on the scientific and technological knowledge available at the time it was originally set. The European Commission has proposed to lower the limit to 0.01 f/cm^3 in Directive 2009/148/EC, to reduce the risk to workers and the public (Amand-Eeckhout 2023).

There are also model codes of practice on *How to safely remove asbestos* (Safe Work Australia 2020a) and *How to manage and control asbestos in the workplace* (Safe Work Australia 2020b). The codes provide guidance on a hierarchy of risk controls, where the most effective and reliable level of protection is to eliminate the hazard (i.e. airborne asbestos fibres) and this must be considered first. The lowest level of protection involves minimising exposure by using administrative controls (i.e. asbestos warning labels and asbestos registers) or personal protective equipment. Proactive and planned removal is the most effective control to eliminate the risk of exposure.

Asbestos-related WHS requirements extend to residential properties if contractors are carrying out work on the property. Apart from this, the management of asbestos in the residential environment varies across jurisdictions, with some relevant provisions in public health, environment protection and dangerous goods laws.

The model WHS Regulations require a PCBU to ensure that:

- all asbestos or ACM at the workplace is identified or assumed by a competent person, so far as is reasonably practicable
- an asbestos register is prepared and kept at the workplace
- an asbestos management plan is prepared where asbestos is identified or likely to be present from time to time
- before demolition or refurbishment is carried out at the workplace
  - the asbestos register is reviewed
  - the presence of asbestos or ACM is determined
  - asbestos or ACM that is likely to be disturbed is identified and so far as is reasonably practicable, removed.

The model WHS Regulations require asbestos to be removed from workplaces by a licensed asbestos removalist. Class A licences allow the removal of both friable and non-friable asbestos, and Class B licences allow the removal of only non-friable asbestos.

In all states/territories except for the ACT, WHS laws do not require licensing for the removal of:

- 10 m^2 or less of non-friable asbestos or associated asbestos-contaminated dust, or
- asbestos-contaminated dust or debris that is only a minor contamination.

Victoria's occupational health and safety (OHS) regulations have an extra element of timed restrictions for removal.

The '10 square metre exception' enables a tradesperson, such as an electrician or plumber, to remove an incidental amount of asbestos. This facilitates basic renovation or repair, for example, removing:

- a single asbestos cement sheet of 2 m^2 to enable the installation of an air conditioner
- a 1.6 m^2 asbestos cement eave to enable access for pipes.

Control measures are required for both licensed and unlicensed asbestos removal.

Work classified as ‘high-risk construction work’ requires a Safe Work Method Statement (SWMS) to be prepared. High-risk construction work includes work that involves, or is likely to involve, disturbing asbestos (ASEA 2021f). This applies to licensed and unlicensed asbestos removal undertaken at a workplace. Licensed removalists are also required to develop an Asbestos Control Plan (ASEA 2021f).

2.5.2 Environment protection

In most instances, jurisdictional environment protection laws place a ‘general environment duty’ on people to take reasonable and practicable measures to prevent or minimise environmental harm and, in some cases, harm to human health. These laws target the prevention of a range of environmental harms, including air, land, water and noise pollution, waste and land contamination. All jurisdictions have offences in those laws that may be relevant to the management of asbestos, such as offences for pollution and environmental harm.

Laws dealing with contaminated land are designed to prevent risks to human health and to the environment. The mere presence of asbestos on or in the soil does not in itself lead to a risk of harm to human health. Determining potential risks to human health depends on the circumstances at each site and include assessing the likelihood that asbestos will be disturbed and therefore pose a risk due to the release of airborne fibres.

Depending on the jurisdiction, the main factors that need to be considered for site contamination are:

- whether the amount of asbestos in soil is equal to or above prescribed levels
- the potential risk to human health
- the risk of material or serious environmental harm, as defined in the relevant environment protection law.

Environment protection laws in all states and territories except Victoria rely on the health screening levels in the National Environment Protection (Assessment of Site Contamination) Measure 1999 (the NEPM ASC) to assist land users in determining if a site is contaminated (ASEA 2021c: 17).

In Victoria, the obligation to report contamination is triggered where a person is, or is likely to be, exposed to airborne asbestos fibre levels of above 0.01 f/mL by means of inhalation.

Environment protection laws in all jurisdictions require the notification of contaminated sites to the environment regulator. Sites with significant contamination can be added to a contaminated sites register, in addition to acquiring remediation, rehabilitation and management obligations. Local councils may also limit the use of contaminated sites using planning and development laws. A notable declared contaminated site is Wittenoom in Western Australia, which comprises around 50,000 hectares (WA Government 2023).

In practice, contaminated site requirements may allow asbestos to be left on site and assessed using the NEPM ASC or, in Victoria may require air monitoring to analyse the level of airborne asbestos fibres to help with determining next steps. If asbestos needs to be removed off-site, it is then considered to be asbestos waste and needs to be classified as such. This is known as the on-site/off-site rule.

In some jurisdictions, there is a threshold for determining if waste is asbestos waste. In all jurisdictions, ‘waste’ has a broad meaning which includes ‘discarded’, ‘surplus’ or ‘abandoned’ substances or matter.

Transportation, storage and disposal of asbestos waste

The Australian Dangerous Goods Code (ADGC) is developed and maintained by the National Transport Commission (NTC 2022). Each state and territory implement the code through their dangerous goods transport regulations separately. Asbestos is a Class 9 substance in the ADGC (NTC 2022) and guidance to assist with implementation of the AGDC (e.g. WorkSafe ACT n.d.) states that all asbestos waste must be loaded, transported and unloaded in a manner that will prevent the escape of any respirable asbestos fibres under normal conditions of transport. The ADGC stipulates that friable asbestos is classed as a dangerous good; however, non-friable asbestos that is double bagged and wrapped is not (see Special Provision 168, NTC 2022).

Domestic asbestos waste

Most jurisdictions provide an exception for unlicensed persons to transport and dispose of less than 250 kg of asbestos waste. This exception allows for domestic volumes of asbestos waste to be transported easily and cheaply to the nearest licensed asbestos waste disposal facility.

Commercial asbestos waste

Some jurisdictions require an environmental authorisation to transport commercial asbestos waste **intrastate** (in accordance with the ADGC). All jurisdictions track and require an environmental authorisation to transport asbestos waste interstate in accordance with the National Environmental Protection (Movement of Controlled Waste between States and Territories) Measure (NEPC 2017). General requirements for transporting asbestos waste include:

- asbestos-contaminated waste must be wetted down
- all asbestos waste must be transported in a part of the vehicle that is covered and leak-proof.

State and territory governments capture data on asbestos-contaminated waste from their tracking systems for hazardous wastes and/or reports from licensed landfill operators (Latimer 2022: 95). A prominent challenge in gaining a national picture of asbestos disposal is that states and territories consider and report different types of waste under the asbestos umbrella (Latimer 2022: 95). This is partly due to the differences in whether and how states and territories distinguish ACM from soil and rubble contaminated with asbestos (Latimer 2022: 95).

In all jurisdictions, transfer stations (facilities that receive and temporarily store waste from other sites) require an environmental authorisation to accept commercial loads of asbestos waste.

Under WHS laws, storage and reuse of asbestos in workplaces is prohibited. WHS laws include a requirement for all friable asbestos material to be kept in a sealed container.

Environmental laws prohibit the recycling or reuse of asbestos products or asbestos-contaminated waste.

Under WHS laws, asbestos waste must be disposed of as soon as practicable at a site authorised to accept asbestos waste. Under environmental laws, disposal facilities require an environment licence to accept asbestos waste.

Waste infrastructure

ASEA maintains an asbestos waste facilities database, drawing relevant information from publicly available sources (e.g. council websites; ASEA 2023b). Following the most recent update in early 2023, there are 280 facilities licensed to accept asbestos waste in Australia (**Table 1**). It is noted that while licensed, some facilities may choose not to accept asbestos waste for operational reasons (e.g. in Victoria; Sustainability Victoria 2021: 2).

Table 1. Australian asbestos waste facilities in 2023

State/territory	Facilities licensed to accept asbestos waste	Facilities licensed to accept residential asbestos	Facilities licensed to accept commercial asbestos	Facilities licensed to accept both residential and commercial asbestos
Australian Capital Territory	2	2	2	2
New South Wales	82	82	81	75
Northern Territory	4	4	4	4
Queensland	66	63	58	53
South Australia	23	22	23	21
Tasmania	9	9	7	7
Victoria	29	25	18	14
Western Australia	65	64	61	51
Total	**280**	**271**	**254**	**227**

Source: ASEA (2023) Search for disposal facilities | Asbestos Safety and Eradication Agency

The number of sites in Victoria licensed to accept asbestos is forecast to decline to 18 in the next 10 years and to 7 over the next 30 years (Sustainability Victoria 2021: 8). An assessment of hazardous waste infrastructure needs and capacities in Australia in 2022 found that while there may be sufficient overall capacity of landfill facilities (NEPM code ‘N’ and ‘T’; which cover asbestos waste) in each jurisdiction, there remains potential for accessibility constraints on a local and regional basis (Latimer 2022: 154).

The accessibility of asbestos waste disposal facilities was previously examined by Blue Environment for ASEA (unpublished). Stakeholder consultation (including with state and territory government environment agencies and WHS regulators, local governments, private waste facilities and asbestos professionals), as well as survey results and known practices in relation to general wastes, led to the following metrics to describe the proportion of the population within and outside designated convenient travel times to an asbestos waste facility:

- within 40 minutes in off-peak traffic for small domestic loads (under 10 m^2) of non-friable ACMs
- within 2 hours in off-peak traffic for large commercial loads of ACMs and friable asbestos.

Overall, it was calculated that 2.8% (range 0–15.4%) of the Australian population lives more than 40 minutes from a waste facility that accepts domestic asbestos waste and that 0.4% (range 0–13.5%) of the Australian population lives more than 120 minutes from a waste facility that accepts commercial asbestos waste. This research suggests that for most people, accessibility to an asbestos waste disposal facility is convenient. However, larger jurisdictions with relatively higher remote populations, like the Northern Territory, were most affected by longer travel times to asbestos waste facilities. Actual travel times to an asbestos waste facility for Northern Territory localities with populations greater than 1,000 range from 2.5 to 20 hours.

Waste capacity

Australia is one of the highest per capita waste generators in the world (Pickin et al. 2020). In the most recent reporting period (i.e. 2019–2020), hazardous waste made up approximately 10% of Australia’s total waste volume, and asbestos represented the second highest hazardous waste type by weight (Pickin and Wardle 2021). As noted, only 0.4% of the Australian population live in an area that is poorly serviced for asbestos waste disposal. Therefore, the key concern regarding asbestos waste is the future capacity of waste facilities. The 2022 assessment of hazardous waste infrastructure needs and capacities in Australia (Latimer 2022) notes that barriers to entry with relation to asbestos waste are cost-driven and due to compliance needs. More generally, capacity constraints for hazardous material waste across Australia is not significant. While no specific data were available at the time of writing, publicly available data and research indicates that there is no concern for the future waste capacity needed for removal of ACMs in Australia.

Where pressure is placed on waste is in the event of disasters or large projects, which generate significant spikes in hazardous material disposal activity. Regarding large projects, the Barangaroo redevelopment provides as a useful case study. To redevelop and remediate the site, over 550,000 tonnes of waste, some including asbestos, was required to be removed or remediated (Barangaroo Delivery Authority 2019). To do so, dedicated facilities were taken offline for public use.

Similarly, the 2019–2020 Black Summer Bushfires are an example of where local capacity is impacted by disaster and extreme weather events. In NSW, 2,448 homes were destroyed of which 1,124 house demolitions were designated as contaminated with ACMs (AIDR 2020). This led to an influx of 177,124 tonnes of designated asbestos-contaminated waste that had to be treated as hazardous waste.

By way of comparison, a report for the Latrobe Valley Asbestos Taskforce estimated that residential buildings in local government areas (LGAs) such as Wellington in Victoria, which saw vast development at a similar time to the southern highlands of NSW (the region most affected by the 2019–2020 NSW Black Summer Bushfires), have 56.04 m^2 of asbestos per dwelling (Carmicheal and Ockerse 2020). This equates to approximately 0.52 tonnes of ACMs per property, using a conversion of 9.2 kg per square metre of ACMs (NSW EPA and Shoalhaven City Council 2015). If the 2,448 bushfire-affected homes had instead had asbestos proactively removed from them, this would, on average, had accounted for total hazardous asbestos waste of 1,262 tonnes, or less than 1% of the asbestos-contaminated waste arising from their destruction in the bushfire event. Hence, a proactive approach to removal of asbestos is likely to see less asbestos-contaminated hazardous waste over the long term.

Lastly, the shift to renewable and circular economy principles will see a reduction in the pressure on landfill sites where asbestos is disposed. The CSIRO is guiding Australia’s shift into the circular economy. The CSIRO describes the circular economy as ‘…business models and practices that ensure sustainable materials management [by] optimising processes and products for lower material and waste intensity … [and] therefore value adding to materials … multiple times across their life cycle’ (Schandl et al. 2020). The trend towards circularity, reuse and recycling will see additional capacity come online for waste that cannot be reused, such as asbestos. This is likely to improve the capacity of landfills, or at least maintain adequate capacity, without significant new landfill supply.

2.5.3 Public health

Public health laws apply to everyone, including homeowners undertaking do-it-yourself (DIY) renovations.

The laws generally aim to prevent activity that poses a risk to public health and safety; they carry fines or imprisonment for non-compliance with directions. Environmental health officers (EHOs) are appointed to enforce compliance. Appointment could be made under public health and/or environment protection laws. In most jurisdictions, under the laws, EHOs have certain powers of entry, investigation and enforcement where there is a risk to public health and safety. This could extend to entering a house where renovations are taking place and determining whether the asbestos disturbance is causing a risk to public health and safety.

Public health laws in Queensland and Western Australian specifically mentions asbestos.

Specific requirements in Queensland public health laws (Public Health Regulation 2018) include:

- only a Class A licensed removalist is permitted to remove friable asbestos from a non-workplace
- a homeowner can only remove more than 10 m^2 of bonded (non-friable) asbestos if the person holds a current government-approved certificate of education
- measures which should be taken to prevent and control the public health risk in relation to the release of airborne asbestos fibres.

In Western Australian, the Health (Asbestos) Regulations 1992 provides that a person who stores, breaks, damages, cuts, maintains, repairs, removes, moves, or disposes of, or uses any material containing asbestos without taking reasonable measures to prevent asbestos fibres entering the atmosphere commits an offence. The regulations also prohibit anyone from using, selling or supplying asbestos cement products.

2.5.4 Other relevant regulation

In the ACT, the *Dangerous Substances Act 2004* contains a general safety duty that applies to everyone, including householders and additional safety duties that apply where a dangerous substance is used, stored or handled for a business or undertaking. The ACT Dangerous Substances (General) Regulations 2004 prohibits the removal of asbestos from both workplaces and non-workplaces unless it is undertaken by an appropriately licensed asbestos removalist. An exception is if the removal is incidental to minor routine maintenance work or other minor work.

Under the sale of land and consumer laws, both sellers and real estate agents have obligations to tell a potential buyer if a home contains asbestos (ASEA 2021g, unpublished). Reviews and reports making recommendations to achieve asbestos disclosure in residential properties include:

- The 2012 Asbestos Management Review recommended that an asbestos content report be undertaken by a competent assessor to determine and disclose the existence of asbestos in residential properties constructed prior to 1987 at the point of sale or lease, and prior to renovation, together with a property labelling system to alert workers and potential purchasers and tenants to the presence of asbestos.
- A 2017 report by the NSW Ombudsman recommended mandatory disclosure for vendors, by providing a report to purchasers and tenants of properties built before 1988 identifying the presence or otherwise of asbestos materials.
- The 2020 Year One Recommendations of the Latrobe Valley Asbestos Taskforce proposed including in the Property Vendor statement (commonly referred to as the Section 32 statement) the material fact of asbestos presence. It also recommended an asbestos status certificate/report be provided to a rental applicant 7 days before entering a lease.

These proposals are based on traditional consumer protection policies that seek to impose disclosure obligations on sellers of complex goods, such as property, to ensure that consumers have sufficient information upon which to decide.

The proposals seek to address the information asymmetry regarding asbestos for residential properties specifically, given that the identification of asbestos in workplaces is an established requirement under WHS laws in all jurisdictions.

Only the ACT Government has mandated the provision of an asbestos assessment report or, if that is not available, generic asbestos advice for residential properties being sold or leased since 2006. Prior to this, the ACT required homeowners to provide a written notice disclosing what they knew about the location of asbestos on their property. The 2006 changes were designed to provide a more effective yet economically viable asbestos protection regime for ACT residential properties.

2.6 Current compliance costs

2.6.1 Identification and management costs

In addition to the health risks of potential exposure to asbestos fibres if ACM is deteriorating, disturbed or damaged, leaving ACMs in place in the built environment is not cost free.

Workplaces

For workplaces, the costs of in situ management includes regular inspections to monitor ACM condition; ongoing treatment and maintenance ACMs (e.g. sealing or encapsulating); and retaining and updating asbestos registers and management plans to comply with WHS laws (Genever et al. 2017).

The *Decision Regulation Impact Statement for National Harmonisation of Work Health and Safety Regulations and Codes of Practice* (National Decision Regulation Impact Statement) estimated the model WHS Regulations for asbestos would cost about $14 million to implement, while at the same time delivering substantial benefits in the long run from reducing the risk of exposure to asbestos in the workplace (Safe Work Australia 2011: 233).

As highlighted in Section 2.5.1, there are slight differences in how states and territories have implemented the model WHS laws. Although Victoria has not adopted the model WHS laws, the model laws were based on the Victorian OHS Regulations (Safe Work Australia 2011: 200). The most recent regulatory impact statement (RIS) conducted on the Victorian OHS Regulations was in 2017 by Deloitte. It looked at options to align Victorian OHS laws with the model WHS laws for asbestos, included options to remove the requirement for asbestos registers in buildings constructed after 2003 and addressed a regulatory gap where only fixed or installed asbestos needed to be recorded in the register (Deloitte 2017).

The Victorian RIS projected the total cost of complying with asbestos-related obligations in the Victorian *Occupational Health and Safety Act 2004* (Victorian OHS Act) and regulations was $109 million per year in 2017. This estimate was based on survey and interview results obtained from businesses that reported asbestos costs. These businesses reported an average cost of $2,290 (between $48 and $8,372) per medium business and $586,955 (between $500 and $5.5 million) per large business for compliance costs per year associated with the presence of asbestos in the workplace. The main driver of these costs was the maintenance and review of asbestos registers. Small businesses reported no costs. The Victorian RIS notes the estimated averages across all businesses in the Victorian economy would be much lower as many would not face any costs (Deloitte 2017: 167).

Assessment and testing costs

Under the model WHS laws, a person with management or control of a workplace may identify asbestos or ACMs by the analysis of a sample of material taken from the workplace (Safe Work Australia 2020b: 18). Asbestos must be tested at a facility accredited by the National Association of Testing Authorities (NATA) or otherwise approved or operated by the regulator (Safe Work Australia 2020b: 18). The cost will vary between laboratories and whether one sample is tested or multiple. The cost ranges between $40 to $140 (NSW Government 2020). A review of laboratory (NATA accredited) websites shows this price range is now typically $66 to $165 for testing single samples of non-friable material. Prices differ based on the speed of testing (5 days versus same day). Separate prices may be changed based on the number of samples and the type of material to be tested (e.g. dust or soil).

Owners of commercial or investment property may be able to claim tax deductions for asbestos testing (ASEA 2020).

Rate assumed asbestos is proved or disproved

An extensive search of the current literature available was unable to identify the rate at which assumed asbestos is later proved or disproved to be asbestos.

Asbestos registers

Under the model WHS laws, a person with management or control of a workplace constructed prior to 31 December 2003 must ensure an asbestos register is prepared and kept at the workplace. The asbestos register must be maintained to ensure the information in the register is up to date (Safe Work Australia 2020b).

In 2012, the Western Australian RIS on adopting the model WHS Regulations showed present value costs at 4% and over 20 years to be $41 million for asbestos registers (Marsden et al. 2012a: v). This was based on changing Western Australian laws to require a competent person to create an asbestos register for buildings constructed prior to 2003 instead of 1990. The cost was estimated to be $2,000 per workplace (Marsden et al. 2012b). It was determined that for the change to be beneficial, it would need to save at least 1.15 people per year with a disproportional factor applied, given the likelihood of death from an ARD (Marsden et al. 2012b).

Management plans

Under the model WHS Regulations, a person with management or control of a workplace must ensure a written asbestos management plan is prepared if ACM has been identified (Safe Work Australia 2020b). A report prepared for ASEA included stakeholder estimates of the following costs associated with managing ACM in situ:

- reviewing asbestos management plans and asbestos registers (at least once every 5 years) of $60 to $100 per hour
- audit/ inspection of the asbestos register and locations of ACM (annually or less) of $60 to $100 per hour
- maintenance and repair costs of $70 to $100 per hour (Behrens and Tunny 2019: 5).

Table 2 shows the published costs of services and goods associated with asbestos management plans for workplaces.

Table 2. Asbestos management plans costs 2023 (including GST)

Operator	Service	Costs from:	Jurisdiction
Greenlight Environmental Services	Preparation of initial management plan if done with audit and register	$550	Victoria
Occupational Safety Solutions	Plan template only	$435	Australia
Xcel Environmental	Preparation of asbestos register and asbestos management plan	$995	Byron Shire, NSW

Sources: Greenlight Environmental Services (2023); Occupational Safety Solutions (2023); Xcel Environmental (2023).

Monitor the health of workers

Under the model WHS laws, a person conducting a business or undertaking (PCBU) has a duty to provide health monitoring to a worker if they are at risk of asbestos exposure when carrying out: licensed asbestos removal work; other ongoing (unlicensed) asbestos removal work; or asbestos-related work. Health monitoring is the monitoring of a worker to identify any changes in their health due to exposure to certain substances, such as asbestos (Safe Work 2020: 4, 6). Health monitoring is costed to the PCBU (Safe Work 2020: 13). Costs involved include health monitoring appointment fees, testing and analysis costs, time to attend appointments and testing procedures and travel costs (Safe Work 2020: 13). Health monitoring is undertaken by a registered medical practitioner with experience in health monitoring (Safe Work 2020: 120).

Residential

Managing asbestos in the home incurs costs (Behrens and Tunny 2019). Where asbestos is removed, a potentially higher insurance premium is avoided (Behrens and Tunny 2019: 5). Research has found that insurance premiums are slightly higher for properties containing asbestos, by around 3 to 5% (Behrens and Tunny 2019: 6). Insurance policies greatly vary but are unlikely to cover asbestos clean up and compensation without additional cover (ASEA 2021d).

The cost of testing ACMs can vary depending on provider expertise and the amount of sampling required (ASEA 2022c). For example, where at least 5 samples are taken, the cost could be around $950 after analysis (ASEA 2022c). Landlords may be able to claim tax deductions for asbestos testing, removal and replacement in rental properties (ASEA. 2020).

Impact of asbestos on property values

Warren-Myers and Cradduck (2021) found that Australian property valuers identified asbestos as a physical risk to properties in valuation practice. The study did not indicate the impact on valuation prices. A US-based study found that the presence of asbestos depreciates house values by 13.44%. Additionally, a 1993 study found that property value is a function of the timing of asbestos removal, and where asbestos is removed outside of the optimal time of removal, the resulting value falls (Fisher et al. 1993). While the literature suggests the presence of asbestos influences property prices, there is a lack of literature published in the last 5 years directly relevant to an Australian context.

2.6.2 Removal costs

There are costs associated with ACM removal and disposal, including preparing ACMs for disposal. Behrens and Tunny (2019:6) found that the significant upfront costs of asbestos removal appear to be the main deterrent to many businesses, with most businesses opting for in situ management.

Workplaces

The cost of asbestos removal can vary depending on various factors such as the types of ACMs needing to be removed and the location of ACMs (Behrens and Tunny 2019: 6).

Asbestos removal companies identified a median 20% cost difference between planned removal and urgent removal (Behrens and Tunny 2019: 6). By bringing forward asbestos removal, costs are avoided from future unplanned service disruptions due to asbestos issues on site (Behrens and Tunny 2019: 6). Stevenson et al. (2023) recognised that planned removal of asbestos from buildings is more cost-efficient than unplanned because early removal limits the risk of disease and additional costs required for friable asbestos removal.

The RIS on the Victorian OHS Regulations found that, of those that reported OHS Act and Regulation compliance costs associated with undertaking asbestos removal work, the average cost was $67,138 per small or medium business per year with estimates ranging between $7,853 and $165,951, noting that no large businesses reported costs in this area. The drivers of this cost were the requirement to be licensed (40%), the safety management system requirement for Class A removalists (30%) and other requirements (30%) (Deloitte 2017: 167). The Victorian RIS notes the estimated averages across all businesses in the Victorian economy would be much lower as many would not face any cost at all.

It has been recognised that the presence of asbestos adds cost to demolition work. One publication estimated asbestos removal during demolition of a home can add up to $2,500, dependent on factors such as the type, quantity and location of the asbestos (Delahunty 2022). Another publication suggested the average demolition cost for an Australian home increase from $16,000, to between $20,000 to $30,000 if ACM removal is part of demolition works (Taylor 2022).

There are license costs associated with asbestos assessment and removal. The data demonstrate that costs vary across jurisdictions. Costs also differ depending on the type of licence required, that is, either an asbestos assessor licence, a Class A asbestos removal licence, or a Class B asbestos removal licence. For example, the cost of a new asbestos assessor licence is generally less than $1,000 but ranges from $85 in Tasmania (Service Tasmania 2022) to $7,417 in Western Australia (WorkSafe WA 2022). The cost of a new 5-year, Class A asbestos removal licence ranges from $202.64 in Queensland (WorkSafe Qld 2022) to $26,780 in South Australia (SafeWork SA 2022), though most are less than $5,000. The cost for a new 5-year Class B asbestos removal licence ranges from $202.64 in Queensland (WorkSafe Qld 2022) to $4,080 in South Australia (SafeWork SA 2022), though most are less than $1,000. Fees for licence renewal are reduced in a third of the jurisdictions. (For further details on licence fees for each jurisdiction, see Appendix 1).

ASEA commissioned research to establish a business case for the management and removal of asbestos. Significant barriers to proactive removal were found, particularly for small businesses. Barriers included an absence of information about how to consider, in commercial terms, the removal of ACMs. However, while the cost savings from early asbestos removal may be higher than the business previously realised, in many cases, there is a net benefit for early removal.

These arise from factors including the avoided cost of:

- reviewing of asbestos register and management plan (5-yearly)
- audit/inspection of ACM condition (annual)
- maintenance to ensure good ACM condition (as needed)
- staff and contractor asbestos awareness training
- future removal and replacement
- business/service interruption
- reduced contingent liabilities
- reduced insurance and workers' compensation premiums
- increased flexibility in building use
- property value uplift
- increased productivity of occupants (Behrens and Tunny 2019).

The research also found that, from a local government perspective, different weightings are placed on the reasons for removing asbestos, but net benefits were also possible from the same factors (Behrens and Tunny 2019). Most councils have specific policies or procedures for managing asbestos; however, financial constraints appear to limit the speed of implementation as not all councils have dedicated funding. In some councils, ACM removal may occur as part of existing building works, under refurbishment funding, or in response to disasters and extreme weather events (Behrens and Tunny 2019).

Residential

As in workplaces, the cost to remove asbestos from homes is also dependent on the removal scenario.

The available literature on asbestos removal costs gives variations in rates and is largely provided by asbestos waste and asbestos removal company websites. The literature provides factors impacting removal rates, such as the condition of the asbestos, the location of asbestos in the home, and the quantity of asbestos (GBAR Group 2022; Kulkarni 2023). Average costs may range between $50 per square metre to $175 per square metre (GBAR Group 2022; AZTECH 2023; Rapid 2023). Rates can also be charged per lineal metre, cubic metre, or per removal of eaves or cladding sheet (GBAR Group 2022, AZTECH 2023). Some may also impose a minimum charge (Rapid 2023). One Queensland asbestos removal company reported on homeowner expenditure for removal works across 542 projects. No date for the projects was available, but data shows most asbestos removal projects cost homeowners between $4,890 and $12,483, with the average project costing $10,685 (Hats for Houses 2017).

The cost of DIY asbestos removal is not comprehensively covered in literature but is thought to vary depending on the approach of the individuals. Assuming safety measures set out in guidance are used, purchase of equipment such as disposable coveralls and gloves, P2 respirators, plastic sheeting, asbestos waste bags and disposable cleaning materials would be required. Hire of a Class H vacuum cleaner with HEPA filters may also be needed (ASEA 2022e).

DIY removal can incur extra costs in Queensland, where an additional cost to obtain a certificate of competency to remove more than 10 m^2 of non-friable asbestos is required (Queensland Government 2019). Currently, approved courses are provided through Keys Human Resources or a registered training organisation (Queensland Government 2019). The cost through Keys Human Resources is $125 (Keys Human Resources 2013).

In the ACT, DIY removal is not allowed by law (ASEA 2017b), so costs are as per licensed removal fees.

The ACT Government established the Asbestos Response Taskforce to address the ongoing public health and safety risks posed by loose-fill asbestos insulation in Canberra homes. On the basis that there was no effective, practical and affordable method to render homes containing loose-fill asbestos insulation safety to occupy, a scheme was established to buy back and demolish affected properties, before remediating blocks for resale. The scheme commenced in 2015 and closed at the end of 2022 (ACT Government 2022a).

Over its 8 years of operation:

- 991 properties were acquired to the value of $714.2 million
- 1,006 affected properties were remediated at a cost of $128.7 million; this includes 30 properties that were privately demolished
- 967 remediated blocks were sold for a total of $646.4 million (ACT Government 2022a).

The total cost of the scheme was reported to be $914.8 million to 30 June 2022 (Lindell 2022); 27% less than originally anticipated. This was primarily due to lower-than-forecast remediation costs and great than forecast land value (ACT Government 2022a).

Attitudes to asbestos risk and willingness to pay

Ipsos Social Research Institute (2018: 2) found that cost is the main factor for homeowners relating to asbestos removal, along with low levels of risk literacy relating to ACMs. People are more likely to remove asbestos where they perceive a likelihood of adverse health impacts (Ipsos 2018: 2). People are also more likely to remove asbestos when government initiatives reduce the costs of removal and disposal (Ipsos 2018: 2). Interest-free loans were suggested as an effective means of increasing removal (Ipsos 2018: 4).

The 2018 national benchmark survey of awareness and attitudes to asbestos found that there has been an increase in people's perception of being informed about asbestos and its dangers (ASEA 2018). Of those who removed it themselves, 39% said it was to save money, reaffirming the above findings. Knowledge and confidence levels regarding asbestos are relatively low, with 2 in 3 people at most able to identify correctly potential sources of asbestos (SECNewgate Research 2021).

2.6.3 Transport and disposal costs

Licence cost to transport asbestos waste

Licence requirements for the transport of asbestos waste vary across jurisdictions. Available literature regarding licensing is scattered across various state and territory websites and regulations. Not all states and territories require licensing to transport asbestos; for example, permits are not required in the ACT or Western Australia (WorkSafe ACT n.d.; DER 2015). For those states that do require licensing, costs and conditions vary. For the financial year 2023–24, the cost of a registration or licence to transport asbestos waste ranges from $356 (200 fee units at $1.78 per fee unit) in Tasmania (EPA Tasmania 2021; DTF 2023) to $729 in Queensland (Business Queensland 2023).

Cost to establish/extend existing waste facilities

An extensive search of the current literature was unable to identify costs to establish or extend existing waste facilities.

Cost of disposal to the waste facility operator

The cost of disposal to the waste facility operator is unavailable in the current literature.

Cost of disposal to the client/disposer

Government waste levies are intended to encourage the recycling and reuse of materials (NSW EPA 2023a). Recognising that asbestos waste cannot be reused or recycled, government waste levies have mostly been removed from asbestos. Gate fees still apply, which are set by the waste facility operators, and there may be additional costs associated with asbestos waste if it is presented to waste facilities incorrectly packaged, or in some cases, this can mean disposers are turned away. The cost of asbestos waste disposal to the disposer varies between jurisdictions and is calculated in a variety of ways: per tonne; per cubic metre; per square metre; per trailer loads of various sizes; per type (friable, non-friable); whether from residential or commercial sources (usually significantly cheaper for residential sources); and whether from within the council area or from outside, including being free for residents in some cases. **Table 3** provides an overview of the cost variation between jurisdictions for the most common cost calculation methods.

Table 3. Asbestos waste disposal costs

State/territory	Cost per tonne (range)	Cost per cubic metre (range)
Australian Capital Territory	Residential – free (less than 250 kg) Commercial – $43 per load (under 250 kg), $174 per tonne (over 250 kg)	n/a
New South Wales	$182 – $600	$170 – $360
Northern Territory	$324 – $630	$110 – $880
Queensland	Free – $988	Free – $307
South Australia	$171 – $500	$220 – $400
Tasmania	$190 – $202	$60 – $383
Victoria	$168 – $338	$60 – $101
Western Australia	Free – $330	$65 – $635

2.6.4 Environmental costs

Cost of cleaning up asbestos-contaminated land

Costs of cleaning up asbestos-contaminated land are generally borne by the party who caused the contamination, if known and/or still in existence. The case studies in **Table 3** arose due to site redevelopments or 'duty of care'-related clean-up programs, rather than prosecutions. Clean-up costs attributable to asbestos alone are difficult to estimate. For instance, costs shown in the Cox Peninsula Northern Territory case study in **Table 3** included remediating soil containing asbestos, lead, polychlorinated biphenyls and pesticides. In addition to contaminated soil removal and/or remediation costs, ancillary or indirect costs associated with contaminated land clean up, such as community and other stakeholder consultation, consequential remediation works and ongoing monitoring post-clean up, may be included in the total costs shown.

Table 4. Asbestos-contaminated land clean-up cost case studies

Location	Year	Cost
Canberra CBD, ACT Remediation of a large development site at Campbell with approximately 52,700 tonnes of asbestos-contaminated soil removed. Cost to ACT taxpayers/funded by the ACT Government.	2013–2015	Approximately $15 million 'as well as the development of infrastructure (roads, footpaths, sewerage systems etc.)'
Cox Peninsula, Northern Territory Remediation of a former Commonwealth defence and communication facility involving 28,000 cubic metres of contaminated (asbestos, lead, PCB and pesticides) soil prior to returning to the Indigenous community. Cost to Australian taxpayers/funded by the Australian Government.	2016–2017	$31.5 million, including ongoing asbestos management
Launceston, Tasmania Targeted removal of approximately 300 m^2 asbestos-contaminated soil from an undercroft at Launceston Airport terminal building. Funding source unknown (not published).	2017	Approximately $100,000
Lyneham, ACT Removal of approximately 13,200 tonnes of asbestos-contaminated soil during sports precinct redevelopment. Cost to ACT taxpayers/funded by the ACT Government.	2013	Approximately $3.5 million

Location	Year	Cost
Aṉangu Pitjantjatjara Yankunytjatjara (APY) Lands, South Australia Remediation of 4 landfill sites covering a total area of hard waste of 387,000 square metres at a remote Aboriginal community. Cost to South Australian taxpayers/funded by the South Australian Government.	2014–2017	$3.6 million
Lower Eyre Peninsula, South Australia Targeted asbestos removal of approximately 230 tonnes of asbestos debris and contaminated soil from privately-owned land following asbestos contamination from damage during bushfires at Sleaford Mere. Cost to local council ratepayers funded/funded by the local council but with costs charged against the affected property.	2013	Approximately $110,000

Source: ASEA (2017c). Case Studies of Contaminated Land – Final Report. Asbestos Safety and Eradication Agency

Cost of cleaning up asbestos following extreme weather and other disasters

The presence of ACMs is understood to increase the time and cost of cleaning up following extreme weather and other disasters that impact property (Khatib et al. 2023). However, literature rarely isolates the costs of dealing ACMs within the broader clean up and disaster recovery efforts, and so is not available for this literature review. However, **Table 5** provides examples of asbestos management in disaster event to contextualise the large-scale impact on different communities, government agencies and industry experts involved in the clean-up.

Table 5. Asbestos management in recent disaster events

Incident	Management details
Black Summer Bushfires, NSW September 2019 to February 2020 5.5 million hectares of land was burned across NSW; 26 lives lost; 2476 homes, 284 facilities and 5,469 outbuildings destroyed; 1,013 other homes, 194 facilities and 2,042 outbuildings damaged – 40% estimated to contain ACMs. Over 5,000 fire and emergency service personnel involved, including from interstate and overseas.	The NSW Bushfire Clean-up Program engaged Laing O'Rourke as managing contractor to clear debris from fire-damaged properties across NSW and make communities safe as quickly as possible. Cleanup commenced January 2020 and was completed by July 2020, with 340,000 tonnes of waste cleared and all asbestos-contaminated waste deemed as friable. The Australian Government committed $2 billion to assist individuals and communities impacted by the fires; insurance claims for NSW totalled $1.88 billion.
Cyclone Seroja, Mid-west region of Western Australia 11–12 April 2021 Category 3 tropical cyclone impacted a 770km stretch of coastline, affecting 16 local government areas. No lives lost. Significant building damage to 70% of all buildings in Kalbarri and Northampton, mostly lost roofs but also other structures destroyed (10% completely). Many of the damaged properties contained ACMs.	Cleanup involved removal of large amounts of asbestos by an Asbestos Risk Management Division of the Seroja State Recovery Operations team. An asbestos management plan was developed. Contractors were engaged to execute the plan including atmospheric monitoring, identifying and securing asbestos-contaminated debris by the application of sealant to prevent the release of asbestos fibres, followed by removal and disposal. Insurance claims totalled approximately $400 million dollars.
Wickham Wool Store fire, City of Newcastle, NSW **1 March 2022** Industrial storage facility with asbestos cement roof caught fire. Asbestos-containing debris travelled to neighbouring areas via the fire's smoke plume.	Local Recovery Committee established to coordinate the cleanup of areas impacted by the fire. Asbestos cleanup, including active air monitoring for asbestos fibres, from March to July 2022; involved 687 homes and public areas like a local school, parks, footpaths, roads, playgrounds, community gardens, sporting fields. $13 million cleanup cost repaid by landowner to the NSW Government.

Incident	Management details
River Murry Flood event, Riverlands and Murraylands, South Australia November 2022 to January 2023 Approximately 4,000 hectares of agricultural land and 4,000 homes (10% primary residences) were affected. A variety of ACMs were in flood-affected residences and businesses, including older holiday shacks.	South Australian State Emergency Services led the response and recovery efforts, with support from Green Industries South Australia (GISA; a statutory corporation of the Government of South Australia) GISA appointed Johns Lyng Disaster Management Australia (a contractor) to coordinate the ongoing clean up, including free asbestos removal, with more than 1,100 tonnes of waste collected to date (April 2023).

Source: Katib et al. (2023a)

Cost of illegal asbestos disposal

The costs of illegal disposal of asbestos waste are difficult to estimate; they are borne by local, state and territory governments, businesses, community groups and individuals (DES 2021). Fines for illegal dumping place a significant cost on offenders. Examples from the past few years provide costs of $450,000 for thousands of tonnes in NSW (EPA NSW 2022a) and $20,000 for a tonne of asbestos plus other waste in Victoria (EPA Victoria 2021b). It is difficult to ascertain costs to the government, councils or ratepayers. Available data often provides costs for illegal dumping without differentiating asbestos from other materials (Moreton Bay Regional Council 2020), and costs vary depending on location, the quantity of asbestos and the processes required to clean up the waste. Data is available from news releases and council media releases on a case-by-case basis, demonstrating a range of costs. **Table 6** lists recent examples of the remediation costs of illegal asbestos disposal and the fines imposed. Note that where perpetrators can be identified, attempts are usually made to also recover costs.

Table 6. Illegal asbestos disposal cost – case studies

State/territory	Date	Waste volume	Remediation cost and fines	Agencies involved
New South Wales (1)	3/5/22	17,600 tonnes	$240,000 fine, order to pay EPA legal and investigation costs of $220,000	EPA NSW, NSW Land and Environment Court
New South Wales (2)	26/8/22	2.5 tonnes	$200,000 for remediation *(no fines as perpetrators unable to be identified)*	NSW Department of Planning and Environment, Crown Lands
Northern Territory (3)	9/5/22	15,000 tonnes	$18 million for remediation, $300,000 in fines	Northern Territory EPA, Darwin Local Court and Northern Territory Supreme Court
Queensland (4)	8/9/22	44,000 tonnes, including asbestos	$7 million annually for Gold Coast Council to clean up illegal dumping, which includes asbestos. 384 fines have been issued since 2019.	Gold Coast City Council, Department of Transport and Main Roads
South Australia (5)	22/9/22	Indeterminate	$1.6 million in foregone waste levy fees from illegal dumping site, $1.1 million in fines	EPA South Australia, Environment Resources and Development Court
Victoria (6)	27/10/21	426 tonnes	$520,000 for clean up	Hume City Council, Wyndham City Council, EPA Victoria
Western Australia (7)	16/3/23	2.2 tonnes	$38,000 in fines	City of Kwinana, Rockingham Magistrates Court

Sources:

(1) *NSW EPA. (2022b). Court orders Director to pay $460,000 for asbestos pollution crimes, accessed 19 July 2023.*
(2) *Carr, M. (24 August 2022). 'Cars, asbestos and more: Aberdare illegal dumping clean-up costs NSW Department of Environment $200,000', Cessnock Advertiser, accessed 19 July 2023.*

(3) Bolatti D. (13 May 2022a). Developer fight fine of $300k for dumping of hazardous materials with $18M clean up bill, Trinitas Group website, accessed 19 July 2023.
(4) Bolatti D. (7 September 2022b). Gold Coast illegal dumpers put on notice, Trinitas Group website, accessed 19 July 2023.
(5) EPA South Australia (21 September 2021). https://www.epa.sa.gov.au/files/15378_media_21sep2022.pdf, accessed 19 July 2023.
(6) Fowler M. (27 October 2021). 'Truckloads of asbestos-ridden soil being dumped across Melbourne', The Age, accessed 21 July 2023.
(7) Department of Water and Environmental Regulation. $15,000 fine for asbestos dumper, WA Government website, accessed 19 July 2023.

2.7 Developments in asbestos law, policy and practice

2.7.1 Australian developments

Novel identification and management approaches

Advancements in technology and increased accessibility to these technologies can offer complementary approaches to traditional asbestos identification and management practices. The development, application and uptake of novel devices and cutting-edge data-driven approaches, for example, can be used to inform targeted on-the-ground asbestos assessment and testing. This will assist with the prioritisation of action, to improve overall asbestos risk management.

Business Research and Innovation Initiative (BRII)

Commencing in 2022, the Australian Government provided grants of $100 000 each to 5 Australian small and medium enterprises (SMEs) to develop technology to address the challenge of real-time and accurate asbestos identification. The aim was to overcome existing technical limitations, to ultimately deliver a solution that is non-destructive (i.e. materials not removed or drilled or disturbed for testing), but still meets regulatory requirements for asbestos identification. Three-month feasibility studies were undertaken, whereby SMEs tested ideas to make the identification of asbestos more accurate in real-time and less burdensome overall.

The 5 SMEs and their devices were:

- Portable Analytical Solutions Pty Ltd – MicroPhazir for in situ testing of 6 asbestos types in bulk and airborne filter samples
- UACS Consulting Pty Ltd – Asbestos Vision, a smart phone app to identify asbestos and connect people
- Alemir International Pty Ltd – ALERT, real-time monitoring and warning device for airborne asbestos
- Flawless Photonics Pty Ltd – hand-portable in situ real-time non-contact asbestos sensor
- PAG R&D Pty Ltd – in situ detection of asbestos in wall panelling using microwave technology (ASEA 2022d).

All 5 SMEs successfully completed their feasibility phase research, with Flawless Photonics and PAG R&D recently progressing to a 15-month proof-of-concept study phase. They will each receive $1 million to continue developing their novel technologies, including prototype building and the scale-up of applications (DISR 2023).

Artificial intelligence and machine learning

Residential asbestos data and information are disparate and dispersed. Detection and prediction-based artificial intelligence (AI) approaches, combined with machine learning (ML) algorithms, offer promising solutions to fill these significant gaps.

Multiple studies have mapped asbestos cement roofs using various types of remote sensing imagery and ML-based image classification methods (Abbasi et al. 2022). Such AI methods for asbestos cement roofing detection offer potential benefits in scale and cost, providing much needed additional data to inform conventional asbestos identification techniques (Hikuwai et al. 2023). In Australia, a small-scale study using advanced AI techniques combined with remote sensing imagery has been used to detect asbestos cement roofing with 94% accuracy (Hikuwai et al. 2023). Urban analytics (i.e. publicly available data to predict areas with a higher likelihood of asbestos presence), high-resolution aerial imagery, ML and predictive modelling have been used to identify over 13,000 asbestos cement roofs (ASEA 2021e). This combination has the potential to provide efficient methods for large-scale detection of ACM roofing, with implications for broader management policies for ACM in the built environment (Hikuwai et al. 2023).

Following on from this, a National Residential Asbestos Heatmap has been developed by predictive modelling, mapping the probability of asbestos presence by geographic area (using the Statistical Area Level 1 (SA1) mapping unit) across Australia. A very small amount of available asbestos data with location based residential information and other predictor data were used for model prediction. Based on the data used, the heatmap provides 94% accuracy of predictions across all SA1s. Overall, approximately 60% of SA1s across Australia have a >99% predicted probability of asbestos presence; this translates to approximately 60% of the Australian population living in areas that have >99% predicted probability of asbestos presence (ASEA unpublished). The heatmap is currently being updated with additional asbestos and updated predictor data (ASEA, personal communication), to continue to provide a useful resource to government stakeholders for asbestos risk management.

Removal schemes

Government expenditure on asbestos removal from public assets commenced as reactive, ad hoc, project-based works. For example, unpublished minute papers from the Commonwealth Department of Housing and Construction record an allocation in the 1984/85 budget of $1.5 million for urgent asbestos removal works for unexpected asbestos finds during Australian Government construction projects, and an additional $1.2 million to survey 60,000 Commonwealth assets for ACMs.

Large-scale, coordinated asbestos removal projects have subsequently been undertaken with government investment to reactively address issues of significant exposure risk to the community or proactively manage the asbestos legacy. Other schemes and available incentives point towards additional means to fund such activities.

Reactive removal

Loose-fill asbestos insulation removal schemes – ACT and NSW governments

From 1968 until 1979, loose-fill asbestos insulation (‘Mr Fluffy’) was pumped directly into the ceilings of domestic homes in the ACT and NSW (Banwell et al. 2016:1). It was predominantly supplied by a firm run by a Mr Dirk Jansen (Banwell et al. 2016: 9). During the 1980s, the Australian Government commenced an asbestos removal program to remove the loose-fill asbestos insulation, first from public buildings and then in 1988 from Canberra’s domestic housing stock (representing the first asbestos removal program; Banwell et al.: 9). The program ran from 1988 until 1993 with responsibility transfer in 1989 to the ACT as part of self-government (Banwell et al. 2016: 9).

This first asbestos removal program was discovered to be inadequate and in 2014, the ACT Government established the Loose-Fill Asbestos Insulation Eradication Scheme to support the removal of ‘Mr Fluffy’ insulation from affected properties in the Canberra residential community.

The scheme was coordinated by the ACT’s Asbestos Response Taskforce and funded by a $1 billion loan from the Australian Government. The scheme used a voluntary buyback, demolition and sales program to achieve its objective of eradicating ongoing asbestos exposure risks from the continuing presence of loose-fill asbestos insulation. The buyback program allowed affected homeowners to sell their property to the ACT Government, who then oversaw the demolition and site remediation process. The sale of remediated blocks recovered some of the costs associated with the scheme and delivered renewed land to the community for rebuilding.

The Asbestos Response Taskforce formally concluded on 30 June 2022, after overseeing the demolition and remediation of over 1,000 affected properties. A smaller coordination team manages any newly identified properties under an ongoing buyback scheme. Further provision to affected individuals continues beyond just the asbestos removal, in the form of the Loose-fill Asbestos Disease Support Scheme, established in 2022. This provides financial support to people with an asbestos-related disease arising from living in a loose-fill asbestos insulation property, where they had no substantial occupational exposure that would allow a workers compensation claim to be made. The ACT and Australian Government have jointly provided a total of $16 million to fund this scheme, which is being implemented and administered by the ACT Government (ACT Government 2022b).

Similarly, in 2015 the NSW Government set aside up to $250 million for the Voluntary Purchase and Demolition Program for homes in NSW found to contain loose-fill asbestos insulation. A Loose-Fill Asbestos Implementation Taskforce (LFAI) was established to oversee and implement the program. Under the program, homeowners could have their homes tested and, if found to contain loose-fill asbestos insulation, are given the option to have the NSW Government purchase the premises and land, or the premises only. Further support for people in affected properties includes financial relocation assistance, assistance in replacing clothing and soft furnishings, independent legal advice, stamp duty concessions, assistance from utility providers and financial institutions, as well as counselling services. As of 2019, 71,213 inspections had been carried out by licensed asbestos assessors, with 151 properties receiving positive test results and 98 demolitions completed. The total cost of those works was $141.4 million, with work still ongoing (Wise et al. 2019).

Other schemes

An alternative model for funding asbestos removal could be a loan scheme, such as that being offered by NSW's Project Remediate for replacing high-risk flammable cladding in residential apartment buildings. This followed an August 2018 ban by the NSW Fair Trading Commissioner on the use of aluminium composite panels with a core comprised of greater than 30% polyethylene. Project Remediate is a voluntary (opt-in) program that offers 10-year interest-free loans to fund the remediation work required to make affected apartment buildings compliant again and applies to an estimated 225 properties. Loans cover the initial investigation, through to design, contracting and construction project management, and include quality assurance services (NSW Government 2023). Both the ACT and South Australia governments are also running similar schemes, including rebates on cladding testing and assessment costs, and concessional (low-interest, fixed rate) loans for up to 10 years to support owners with the costs of replacing the cladding (ACT Government 2023; SA Government 2023). Victoria has a $600 million program facilitated by Cladding Safety Victoria to fund the removal from residential and public buildings (Victorian Government 2023).

Proactive removal

Victorian Asbestos Eradication Agency

The Victorian Asbestos Eradication Agency (VAEA) was established in 2016 to provide Victoria with a coordinated, whole-of-government plan for the ongoing removal of asbestos from its buildings. This includes government offices, hospitals, train stations, community centres, prisons and TAFEs. The VAEA is applying best-practice asbestos management in its approach and has developed a consolidated register of ACMs identified in approximately 13,000 government-owned buildings, a risk assessment model to assess asbestos hazards consistently and a schedule for prioritised asbestos removal (VAEA 2022b). Only Victoria has a statewide schedule for the prioritised removal of asbestos from government-owned buildings, prioritising asbestos removal based on risk. During 2021–22, the VAEA completed the first tranche of removing the most hazardous ACMs, including from many regional TAFEs; important cultural assets; and state-owned community buildings such as public halls, recreation, coastal and conservation reserves, and caravan and camping parks (ASEA 2023a). VAEA's approach prioritises removal; other agencies use a basic compliance approach that avoids asbestos removal and manages ACMs on site (Stevenson et al. 2023).

Victorian School Building Authority asbestos safety program

The Victorian School Building Authority (VSBA), a part of the Victorian Department of Education, manages the asbestos safety program. With a $407 million investment, the VSBA has undertaken the largest scale asbestos removal program ever completed in the state between 2015 and 2020. Following an initial audit in 2015 of 1,712 government school sites, high-risk asbestos was identified at 497 schools and was removed by March 2016. Asbestos which might pose a risk in the future, such as that behind walls or eaves of older buildings, was identified at 1,287 schools and was removed by the end of 2020. Part of the asbestos safety program included the installation of new architecturally designed, permanent and sustainable modular buildings to replace older asbestos-containing buildings (VSBA 2022).

Other state and territory school examples

Schools have been the focus of large-scale asbestos removal programs for most other governments also. In Queensland, asbestos was removed from 196 buildings across 133 state schools during 2020 to 2021, with a further 55 removal works scheduled beyond that timeframe. The ACT Government allocated $15 million over 4 years in its 2021–2022 budget for the removal of hazardous materials, including asbestos, from public schools. In South Australia, asbestos has been removed in over 50 schools as part of a $1.5 billion investment in public education to modernise and upgrade schools. The Tasmanian Government's $3.1 billion construction stimulus package for COVID-19 recovery included a School Revitalisation Maintenance Program worth an initial $10 million, with an additional $6.5 million investment added in July 2020 (ASEA 2022b).

Incentivised removal

Asbestos reports and licensed asbestos removal from commercial or residential properties can make use of existing tax deductions on environmental protection. In 2020, the Australian Taxation Office (ATO) published the taxation ruling TR 2020/2, which allows income tax deductions for 'environmental protection activities' expenditure (ASEA 2020). Under this ruling, those who own a property that provides an income (e.g. commercial or rental properties) can claim some asbestos activities as a tax-deductible expense (ASEA 2020). Activities can include those related to waste disposal (ATO 2020). This ruling provides a monetary incentive for asbestos management and removal.

Transportation – a national system for tracking of asbestos waste

The NSW EPA, in collaboration with the Queensland Department of Environment and Science (DES), is developing a new Integrated Waste Tracking Solution (IWTS) for hazardous and other regulated waste, including asbestos (NSW EPA 2023b). The new digital solution is intended to support a more data-driven and risk-based approach to regulating asbestos waste while making it easier for users to comply with their regulatory reporting requirements.

A nationally consistent system would provide for more effective regulation that improves market stability and confidence, removes duplication, lowers barriers to compliance and enhances the use and accessibility of data. The IWTS specifically will enable analytics and reporting for all data captured from asbestos waste transport. This will enhance data reliability and validity regarding the amounts of asbestos going to flows (waste) and their location (landfills), enabling the rate and progress of asbestos removal and disposal to be monitored, ideally at a national level.

The ambition of this project is to provide a single solution initially for NSW and Queensland, then connect with Victoria's 'Waste Tracker' (EPA Victoria 2023a) and ultimately to plug-in the other jurisdictions. There will be a need for further interjurisdictional collaboration if existing systems are to be replaced with the IWTS on a national scale.

Disposal

As identified earlier, the current policy for managing hazardous asbestos waste is via deep burial in landfill. Australia is one of the highest per capita waste generators in the world and in the most recent reporting period (2019–2020), hazardous waste made up approximately 10% of Australia's total waste volume. Since both reported volumes and projected trends for asbestos waste are increasing (Pickin et al. 2020; Pickin and Wardle 2021; Brown et al. 2023), the long-term sustainability of effective and accessible asbestos waste management is paramount.

Traditional landfill

Jurisdictions have implemented disposal management initiatives to find more cost-effective options to support landfill. For example, in NSW there is a requirement for landfill operators to cover asbestos waste with virgin excavated natural material (VENM) unless a licence variation is granted (NSW EPA 2022b). The NSW EPA, in consultation with SafeWork NSW, has worked with industry to trial alternative cover options such as general solid waste (NSW EPA 2022b). An evaluation of the trial demonstrated no perverse outcomes, showing that general solid waste is a cost-effective alternative to VENM cover and waste facility operators may now apply for permission to use the alternative cover (NSW EPA 2022b).

Alternatives technologies

While current Australian law prohibits the reuse or recycling of asbestos waste, technological alternatives to approved deep burial landfill methods for asbestos waste offer innovative and sustainable solutions to dealing with Australia's asbestos legacy. Such technologies still need to be proven viable, and appropriate policy and regulatory changes must be implemented. Nonetheless, ACMs could be diverted into potentially harmless reusable resources to create economic value, becoming part of a circular economy. This is because alternative asbestos waste technologies aim to render asbestos fibres inactive by altering their structure, and, in some cases, producing a reusable product claimed harmless to health (Khatib et al. 2023b).

Alternative asbestos waste technologies can be broadly categorised as thermal, chemical, mechanical and biological, based on their main mechanism of action, and a combination of techniques may be used to make the process more efficient (Blansch et al. 2018; CNR-IIA 2018; Paolini et al. 2019). Efforts being explored in the Australian (and nearby) regions include thermochemical, biological and mechano-chemical techniques, such as:

- Thermo Chemical Conversion Technology (TCCT) has been explored in the Australian context since 2018, but despite government support via business investment and innovation grants, a pilot plant is yet to be established (GrantConnect 2018).
- An international consortium of researchers from three different countries (including Australia, New Zealand and the United States) is seeking to take advantage of biological remediation in practice, to manage legacy asbestos sites by creating 'activated landfills. They propose to use controlled ecosystems that incorporate bacteria, fungi and plants in a systematic way, to define the optimal conditions that achieve asbestos remediation within a reasonable timeframe (e.g. 5 years; Wallis et al. 2020).
- Finally, a New Zealand, United Kingdom, and Hong Kong-based company with a patented mechano-chemical destruction system (milling apparatus) claims that in recent trials, asbestos destruction of ACMs occurred at temperatures that did not exceed 180 °C and that the resulting by-product powder can be reused as a high-grade cement additive (Williams and Black 2023; EDL 2018a; EDL 2018b).

The biological and mechano-chemical approaches described above represent low-energy methodologies that offer a more sustainable approach to managing asbestos waste in the long term. Alternative waste technologies in the international context are described in the next section.

2.7.2 International developments

With the progressive implementation of asbestos bans worldwide, nations around the world have endeavoured to assess their asbestos legacy to facilitate long-term management and removal plans. In the European Union (EU), universal prohibition of the production or importation of ACMs was enacted from 1 January 2005, after a 1999 agreement by the EU Commission allowing a 5-year transition period; many nations had implemented their own bans earlier (e.g. 1999 in United Kingdom, 1997 in Poland and 1992 in Italy).

Identification and management

European Union

In the European Union (EU), moves towards sustainable environmental practices demonstrate implications for asbestos exposure. Buildings are responsible for 40% of the EU's energy consumption, and only 1% undergo energy-efficient renovation per year (European Commission 2020). As part of the EU's European Green Deal, the Renovation Wave Strategy aims to reduce energy-related greenhouse emissions by doubling the annual rate of renovations of buildings by 2030 (European Commission 2022).

However, this means an increased asbestos exposure risk for those in the construction sector (ECHA 2021). To protect people from exposure, the European Council has reached provisional agreement with the European Parliament to reduce the OEL for asbestos and provide for more accurate ways of measuring exposure levels in line with the latest technology.

Following a maximum transition period of 6 years, member states will be required to implement a new method for measuring asbestos levels, electron microscopy (EM), which is more sensitive than the commonly used phase-contrast microscopy (PCM) and makes it possible to measure thin asbestos fibres. Member states will have 2 options:

- to measure thin asbestos fibres, in which case the maximum exposure limit will remain at 0.01 f/cm^3
- not to measure thin asbestos fibres, in which case the maximum exposure limit will be reduced to 0.002 f/cm^3 (Council of the European Union 2023).

A recent comparison of microscopy techniques for asbestos testing highlights the limitations of commonly used techniques like PCM and notes the expanding use of EM internationally to overcome these limitations (COHLABS 2021).

United Kingdom

Since 2019 a UK-wide campaign 'Airtight on Asbestos' has been running to influence the Health and Safety Executive's (HSE) approach to asbestos management to reflect the risk more accurately to public health. The campaign calls for a reconsideration of the approach that underpins the UK's Control of Asbestos Regulations (CAR) 2012, which provide that ACMs should be maintained rather than removed.

In 2022, the UK's Work and Pensions Committee reported on the HSE approach to asbestos management (the UK parliamentary report) and made several recommendations to the UK Parliament, including a centralised asbestos register, lowering the OEL, increased inspection and enforcement activity, accreditation of assessors, and the removal of asbestos within 40 years (Work and Pensions Committee 2022a).

The 2022 UK parliamentary report suggested that having a central register of information on asbestos in buildings could improve the asbestos-related enforcement, making it more risk-based and targeted. This report recommended the development of a 'central digital register of asbestos in all non-domestic buildings' (Work and Pensions Committee 2022a: 5). The government response to that report did not support the recommendation and noted that the HSE had provided evidence that a new central register would require significant resources from duty holders and government and would duplicate existing information 'with no clear indicator that asbestos exposure risks would be improved' (Work and Pensions Committee 2022b: 3).

The 2022 UK parliamentary report noted the work of the UK National Asbestos Register (UKNAR), a community interest company established in 2022, in developing a national database, Asbestos SMART, which allows existing asbestos registers to be uploaded and linked. Duty holders can then share this information with those who need it. Every building enrolled in the system is issued with a unique QR Code which can be displayed on site. When this code is scanned a copy of the relevant asbestos register will be automatically downloaded. Once the register is accessed it can be carried through the building on a mobile phone or tablet. This would allow tradespeople such as plumbers or electricians for instance to be quickly able to ascertain the location and listed condition of any previously identified asbestos in the building (UKNAR n.d.).

Another UK initiative, a data analysis report into asbestos in UK buildings (Richards et al. 2022) summarised analysis of anonymised asbestos surveys between October 2021 and March 2022. The report was compiled in response to the 2022 UK parliamentary inquiry because it appeared that little evidence existed about the extent and condition of asbestos in UK buildings. It sought to collate a sample of accredited asbestos survey data and found that a significant percentage of sites had asbestos with varying levels of damage. The report found that 'this demonstrated that data was available that could inform an analysis of the UK's asbestos legacy in buildings'. However, it noted some limitations and suggested that 'before any work is undertaken to develop a national asbestos database, an effort is made to standardise the data collection and reporting terminology between the existing database systems' (Richards et al. 2022).

The government response largely rejected the other recommendations. In terms of lowering the exposure limit, HSE stated it would continue to monitor developments and evidence to consider change (House of Commons 2022:5). In relation to increasing inspection and enforcement activity, it stated it would deliver interventions based on intelligence, targeting the most serious risks (House of Commons 2022:6). In relation to accreditation of assessors, it stated it would engage with stakeholders to ensure competence is enabled throughout the system (House of Commons 2022:8). In relation to the removal of asbestos within 40 years, it emphasised its management approach and rejected a deadline for removal (House of Commons 2022:10).

These decisions were informed by the Second Post Implementation Review of the CAR 2012, conducted by the HSE in 2022, which concluded that it still has a net present value to society of £16.3 billion (Mitchell et al.

2012). A cost–benefit assessment was undertaken that indicated the benefits of CAR 2012 outweighed the costs and will continue to do so for the foreseeable future (at least over the 100-year appraisal period). The benefits of CAR 2012 were assessed through considering scenarios of avoided health costs of asbestos-related cancer, in particular mesothelioma. The scenarios assessed were applying all the risk-control actions prescribed in CAR 2012 versus applying no risk controls. Costs included those arising from all types of asbestos management and removal work. In the UK, this is categorised as licensable work, notifiable non-licensed work, non-notifiable work and duty to manage, with activities aligned to specific regulations in the CAR 2012. The amount of asbestos management and removal work was forecast based on asbestos-containing building stocks from different construction periods estimated to still be in existence today and considering a natural attrition of asbestos-containing building stock due to demolition or complete renovation over 100 years (Mitchell et al. 2012).

A consideration of changes to CAR 2012, such as improved regulations or increased removal rates, was not costed. Demands continue for such changes, including in July 2023, where The Sunday Times launched a campaign calling on the government to take action to have all asbestos removed from buildings over the next four decades (The Sunday Times 2023). It has been investigating asbestos in schools and reports that as many as 10,000 pupils and staff may have died due to exposure to asbestos fibres since the 1980s.

Removal

The utility of AI-driven applications has shifted from mapping natural land, to analysing land use and more recently, assessing the urban environment (Abbasi et al. 2022). Localised and strategic ACM removal plans being advanced with AI are evident in Poland, Flanders/Belgium, Italy and Spain. This includes not only the geospatial mapping of asbestos data, but also the centralisation of information to further inform strategic actions. Asbestos legacy information and proactive removal action exists also for the Netherlands and Korea.

Poland

From 2004, a mandatory reporting requirement was instigated, to document all asbestos cement products in both private and public properties. Reporting is based on physical field surveys submitted to local government authorities, and information is compiled in a national online inventory (Polish Ministry of Economic Development and Technology 2018a). The Polish asbestos legacy was estimated to be 15.5 million tonnes in 2003, with ACMs flagged for progressive removal in stages up to 2032 (Polish Ministry of Economic Development and Technology 2018b). The pace of ACM removal has been slower than planned, and deficient documentation of ACM removal due to the manual reporting process has also been described (Szymańska and Lewandowska 2018).

Incomplete and poor-quality reporting was confirmed using data validation by AI approaches. Using a similar methodology to that applied in the ASEA roof hotspots project (ASEA 2021e), underestimation and incorrect classification of asbestos cement roofs was identified in a small (127 km^2) rural region (noting that rural regions in Poland have relatively higher ACM quantities; Krówczyńska et al. 2020). AI has also enabled the specific asbestos cement roofing legacy to be estimated at approximately 8.2 million tonnes of Poland's total ACM legacy, based on analysis by aerial imagery and data analytics (Wilk et al. 2017). Numerous other studies using a variety of AI methodologies have been undertaken in various regions across Poland (including in large cities, smaller towns and mountainous national parks) since 2015, to optimise asbestos cement roof detection and aid with validating the amount of asbestos cement products listed in the national online inventory (Książek 2018; Nimbalkar et al. 2018; Krówczyńska et al. 2017; Wilk et al. 2017; Krówczyńska et al. 2016; Osińska-Skotak and Ostrowski, 2015). The different models have revealed overall prediction accuracies ranging 61–94%, and factors such as roofing area and colour have been shown to influence the results.

Flanders/Belgium

In Flanders, the asbestos legacy was estimated to be 3.7 million tonnes in 2015 based on a manual inventory process with 0.9 million tonnes existing in the residential environment. It is currently estimated that 2.3 million tonnes of ACMs remain, following the implementation of the 'Asbestos-safe Flanders' policy. The aim was to phase out high-risk ACMs (listed as, for example, asbestos cement roofing, façade cladding, easily accessible non-bonded/friable applications) by 2034, and to achieve its remaining goals by 2040. To target action, geospatial mapping of the asbestos legacy is being undertaken using ACM data from the

Public Waste Agency of Flanders (OVAM), in combination with high-resolution aerial imagery, remote sensing and deep-learning AI techniques to automate detection in buildings. Prioritised ACM removal is being linked with energy efficiency programs where it is cost-effective to do so, such as the subsequent installation of solar panels (VITO 2019; OVAM 2016).

Since 23 November 2022, building owners who are selling their property (built before 2001) need to have an asbestos certificate. This certificate specifies whether the home contains ACMs. By 2032, all homes built before 2001 will need to have this certificate (ACA Group 2023) and this can be supplied during inspections by asbestos experts, who can then upload details into an app which feeds into the national asbestos inventory (VITO 2019; Blansch et al. 2019).

Italy

During the 20th century, Italy was the main producer and a high consumer of asbestos in Europe. It is perhaps not surprising then, that Italian researchers have led the way with asbestos cement roof classification by AI approaches, with evidence of its use dating back to the early 2000s. The aim was to develop time-saving and cost-effective tools to automate asbestos cement roof identification and weathering status, to facilitate removal in line with EU or local directives. Like Poland, national guidelines have been provided to map areas containing ACMs by mandatory declarations to local government authorities. However, the accuracy of this information is considered limited (Tommasini et al. 2019; Marsili et al. 2017; Cilia et al. 2015; Frassy et al. 2014; Fiumi et al. 2012; Bassani et al. 2007).

Hyperspectral data (e.g. Multispectral Infrared and Visible Imaging Spectrometer or MIVIS sensor, and WorldView-3) has been the preferred imagery used (Tommasini et al. 2019), with spatial resolution in the metres range, and different algorithms (e.g. classification by spectral feature fitting or spectral angle mapper or random forest ensembles) have been applied to different-sized study areas (i.e. from 5–3,263 km^2) in different regions around the country (e.g. mountains, valleys, towns and cities) to validate emerging methodology for automated asbestos cement roof detection (Tommasini et al. 2019; Marsili et al. 2017; Cilia et al. 2015; Frassy et al. 2014; Fiumi et al. 2014; Fiumi et al. 2012; Bassani et al. 2007). Overall classification accuracies range from 43–90%, and it has been suggested that AI data be integrated with other relevant information (e.g. population density, distance from areas such as schools or hospitals) to develop prioritised removal strategies.

Spain

In the Catalonia region of Spain, there are an estimated 4 million tonnes of asbestos cement roofs. The DetectA company was recently founded by 3 entrepreneurs, with the aim of mapping the asbestos cement roofing legacy in the region by 2023 and develop a plan for its removal. They are applying a similar approach to that used in ASEA’s roof hotspots project (ASEA 2021e), namely aerial images and machine learning to automatically detect the presence of asbestos cement roofing. To date, they have mapped more than 90% of roofs in the region. The City Council of Cubelles is one of the first to use the technology, with the aim to notify affected property owners by the end of 2021, and budget for the removal of asbestos cement roofing from public buildings commencing in 2022 (DetectA n.d.).

Netherlands

Based on historical consumption data, in 2012, the asbestos legacy (roofing and siding) in the Netherlands was estimated to have an area of 130 million m^2 in total, with 20 million m^2 in the residential sector. This is potentially a smaller overall asbestos legacy compared with Australia, since from the ASEA roof hotspots project (ASEA 2021e) it was estimated that there was 1.48 million m^2 of just asbestos cement roofing in the 771 km^2 area examined. The Dutch Ministry for Infrastructure and the Environment put forward a 2024 deadline for ACM removal, but it has not received full parliamentary approval. Some remediation works have occurred already, removing approximately 33 million m^2 of asbestos in 2016–2018, and funding options to facilitate removal exist until 2028 (Netherland Times 2019; Chemical Watch 2018; Dutch Department of Infrastructure and the Environment | Ecorys 2012).

Korea

Over 1.8 million tonnes of raw asbestos were mined in or imported into Korea, with 96% estimated to have been used to produce asbestos cement roofing. The production of asbestos cement roofing was discontinued in 2006 and a total asbestos ban commenced in 2009. However, based on a 2008 survey, there were over 1.2 million buildings with asbestos cement roofs, of which more than 71% are residential, with many constructed prior to the 1970s. There are regulations requiring condition assessment and, ultimately, government funded removal of asbestos cement roofs. Specific projects targeting ACM removal in rural (farming and fishing) villages commenced in 2010, offering loans for home improvements, demolition and roof removal. Korean government initiatives in 2013 and 2018 have funded the removal of derelict buildings with presumed ACMs through revitalisation projects (Lee and Kim 2021; Zhang et al. 2021; Kim et al. 2020; Kim et al. 2011). In 2017, the Asbestos Eradication at Schools Project commenced, with funding from the Korean Government allocated over 10 years for the removal of asbestos from the country's schools (Kazen-Allen 2023).

Disposal

Alternatives

Although alternative asbestos disposal options have yet to be implemented in the Australian market, internationally there are technologies further progressed in the commercial sense, as well as in earlier stages of the research and development pipeline.

In France, Inertam (Groupe Europlasma), has been operational since 1992 and uses a plasma torch vitrification technique to process asbestos waste (both friable and non-friable types) to create an inert by-product (Cofalit). Development of this facility was initially self-financed, with a prototype plant built first, and commercial scale processing of asbestos waste commencing in 2001. Initially, there were two lines with 0.5 tonnes/hour capacity each. In 2003, a third processing line began to be developed and commenced operations in 2005 with a 2 tonnes/hour capacity, processing up to 30 tonnes of asbestos waste per day (Inertam n.d.).

In 2005, the by-product Cofalit was also approved for recycling as a road-building substrate, and other uses (e.g. storage of solar energy) are currently being examined. Ongoing investments have focused on plant modernisation and optimisation, for productivity gains and reduction of the environmental footprint (Inertam n.d.). In 2022, the facility began receiving asbestos waste internationally (AOF), with plans to expand this type of service (Apim 2022). This takes advantage of the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (UNEP n.d.).

The Tetronics company (UK-based) also provide plasma technology, but only as a trial facility service. The facility allows for hazardous material treatment, including for ACMs. Investment in the trial facility was received in 2007 and it became operational in 2017. Their direct current plasma arc vitrification process produces an inert reusable by-product called Plasmarok, which has been certified for use in a range of civil engineering building applications (e.g. an unbound pipe bedding and road construction aggregate; Tetronics n.d.).

Thermal Recycling is another advanced facility in the UK, with initial testing commencing in 2008 and an operational demonstration plant open since 2020. The demonstration plant was built with funding from private investors. Thermal Recycling uses a denaturing technique to transform chrysotile-containing asbestos cement roof sheets into a new material, that is then recycled to produce a sustainable aggregate (Calmag). The current demonstration plant kiln can process 12 tonnes each firing, whereas a full-scale kiln will denature up to 120 tonnes in each firing. To date, more than 80 tonnes of chrysotile-containing asbestos cement roof sheets have been processed, and the facility has a regulatory permit to treat 29,500 tonnes a year. The next phase involves opening a full-scale plant, with cooperation and support from the asbestos removalist industry. Extending the types and forms of asbestos that are denatured is also anticipated, based on the claims that this denaturing process can be used this way. Research is also currently under way to identify the best use for Calmag, with a focus on road building construction products such as blocks, bricks and pavers (Thermal Recycling n.d.).

In 2021, Netherlands-based Asbeter Holding received EU funding for construction of an industrial plant to process asbestos cement sheets into a carbon-neutral building material. Using a patented alkaline minerals process (termed AC for the active and circular nature of the entire process), the company claim that they will be able to produce a highly sought-after alkali–silicate slurry, thereby reducing the need for raw building materials. Their technology involves an initial mechanical pre-treatment to increase the reactive surface area, followed by the addition of water and heat to create a slurry, and a final alkalinisation step to accelerate the reaction. The technique regains cementitious material for reuse but destroys asbestos fibres from asbestos cement sheet waste, as assessed by the absence of asbestos fibres using scanning electron microscopy. An indicative business plan suggests that the basic concept engineering is ready to be scaled up pending further financial investment, which they are seeking from venture capitalists and banks. The logistics of the safe removal and transport of asbestos cement sheet waste is currently being considered and processing is expected to commence in 2025, with a 75,000 tonnes/year capacity at full scale in 2026 (Asbeter Holding n.d.; van den Berg 2022).

De Dietrich Waste Recycling (DDWR) is another recent approach for the neutralisation of asbestos waste. The DDWR process involves treating asbestos waste with an acidic solution, under low and controlled temperatures, to create environmentally friendly by-products that can be reused in various industrial sectors. The process has been validated with numerous scientific studies over 8 years of research and development, including the granting of patents. Currently, a third-party investor or stakeholder in the asbestos waste sector is being sought to install a first treatment plant (De Dietrich Process Systems 2019; Industry Asia Pacific 2019).

Finally, like the biological remediation of asbestos being researched in the Australian region, an East Netherlands consortium of companies, water boards and knowledge institutions received an EU subsidy (European Regional Development Fund grant) for the period 1 October 2018 to 31 December 2022, with co-financing from other public and private sources, to investigate bioremediation of asbestos (Europa om de Hoek – a). The Fiber2Fiber project sought to determine whether a mixture of microorganisms, seeds and a patented combination of other organic substances, mainly from river sediments (known as ‘Brickz’), would, when added to asbestos-contaminated soil, break down asbestos fibres and render them harmless (Europa om de Hoek – b; Triple E – a). The project concluded with a symposium in December 2022, which asserted that their goal had been achieved, with evidence of the conversion of asbestos fibres (using a combination of fungi and bacteria) into a biomass fibre that could be used as a raw material in the paper industry (Europa om de Hoek – c; Netherlands Institute of Ecology; Triple E – b). Other researchers have also recently found that certain extremophilic bacteria from high temperature marine environments can reduce asbestos toxicity by removing iron, silicon and magnesium from asbestos minerals. Because iron has been identified as a major component driving the toxicity of asbestos minerals much of the research has focused on removing iron from asbestos minerals through anaerobic respiration (Choi et al. 2023).

Monitoring, diagnosis and treatment of ARDs (with a focus on mesothelioma)

Since ARDs typically develop decades after asbestos exposure has occurred, the impact of current efforts to prevent asbestos exposure will not be known until many years later. Even so, despite a ban on asbestos for almost 20 years, and the earlier introduction of more stringent asbestos regulations and workplace safety practices, ARD rates in Australia are not yet reducing significantly. Therefore, current data on the incidence of ARDs are mainly related to past occupational exposures. This means monitoring, diagnosis and treatment remain critical in the ongoing management of ARDs.

Monitoring

The two main data sources for monitoring ARDs statistics in Australia are the Global Burden of Disease program (GBD 2020) and the Australian Mesothelioma Registry (AMR; AIHW n.d.). The GBD program assesses disease burden from major diseases, injuries and risk factors using data collected between 1990 and 2019; deaths from ARDs are those that the GBD study has attributed to the risk factor of past occupational asbestos exposure. The AMR is a registry of all diagnosed cases of mesothelioma in Australia since 1 July 2010; it captures information about mesothelioma incidence and mortality, and asbestos exposure, and is the most up-to-date source of data on mesothelioma incidence (number of new cases) in Australia. While the AMR reports actual recorded incidence and mortality for mesothelioma in Australia, the GBD estimates disease based on known risk factors and other available data. For this reason, estimates reported through the GDB study may differ from year to year to those captured by the AMR, but both data sources are valuable for studying mesothelioma prevalence.

As noted in Section 2.3.2, information collected from detailed exposure assessments carried out by the AMR indicates that both occupational and non-occupational exposure to asbestos are potential contributing factors to the development of mesothelioma cases reported to the registry. However, occupational exposure is by far the predominant exposure for men. Most men had occupational exposure (either alone or also with non-occupational exposure), whereas women had predominantly non-occupational exposure (either alone or also with occupational exposure). Of the 1,067 people for whom exposure was assessed, 93% of women compared to 21% of men reported non-occupational exposure (AIHW 2023a). Current evidence indicates that Australians will continue to be exposed to legacy asbestos occupationally and non-occupationally, and continue to develop ARDs, without targeted action to prevent it (Mahoney et al. 2023).

Diagnosis and treatment

Diagnosis and treatment of patients with ARDs requires a multi-dimensional clinical approach, involving various health practitioners and personalised therapeutic regimes (Kijima et al. 2021; Lee 2021; Ke at al 2021; McLean et al. 2021). Pre-clinical research remains critical in improving our understanding of the molecular mechanisms of ARDs, for developing biomarkers to improve diagnosis and identifying new therapeutic targets (Johnson et al. 2021a; Johnson et al. 2021b).

Mesothelioma and lung cancer outcomes have improved in recent years due to more sensitive diagnostic tools that support earlier diagnosis and improved treatment methods, including advances in surgical techniques and new chemotherapy combinations. Advances in immunotherapy and targeted therapy also offer significant benefits to mesothelioma and lung cancer patients since they can be very effective at treating cancer with fewer side effects.

Immunotherapy aims to slow the growth of cancer or kill cancer cells by altering the body's immune response and is usually associated with less side effects than conventional chemotherapy. Immunotherapy does not work for everyone with mesothelioma, and therapy response for individual patients cannot be predicted at present, but some people may have good results (Cancer Council 2023).

Targeted therapy is a type of drug treatment that specifically works on the changes that make a cancer cell malignant. This slows cancer growth and spread without damaging healthy cells. Targeted therapies sometimes work when standard chemotherapy drugs do not and may have less severe side effects. As researchers learn more about gene and protein changes in mesothelioma, they are hoping that targeted therapy might work for mesothelioma (National Cancer Institute 2022).

Both immunotherapy and targeted therapy are available to lung cancer patients on the Pharmaceutical Benefits Scheme (PBS). Following several clinical trials, immunotherapy is also now available to mesothelioma patients through the PBS. There are currently at least 5 clinical trials for ARDs treatment running in Australia (Cancer Australia 2023).

Ongoing medical research funding is required to sustain improvements in the diagnosis and treatment of ARDs but remains limited. Current research grants in this area include:

- The University of Western Australia receiving $1.5 million by the National Health and Medical Research Council (NHMRC) to conduct clinical trials in mesothelioma to understand from patient tumour and blood samples why some people respond to treatment and others do not.
- The National Centre for Asbestos Related Diseases has a five-year grant (until 2025) worth $2.5 million from the NHMRC for its ongoing study into mesothelioma and lung cancer.
- The University of Western Australia has been awarded approximately $200,000 by Cancer Australia to identify new molecular targets for immunotherapy.
- The University of Melbourne has a five-year grant (until 2025) to better understand the Hippo pathway and its role in mesothelioma and other human cancers.

2.8 Summary

The overview of research and other literature reveals that we know a significant amount about Australia's asbestos legacy and the exposure risks associated with it.

However, the following gaps in our knowledge were identified:

- risk profiling of asbestos-containing materials, including the proportion of ACMs presenting a high risk of releasing respirable fibres and requiring removal, or assumed ACMs later confirmed not to contain asbestos
- impact of ACMs on property values and the time loss of using an asset during ACM removal
- workforce capacity
- impact on the environment.

We engaged with stakeholders to gather the missing insights, information and data. The results are shown in Chapter 4. Collectively, all knowledge on the identified costs and benefits from areas relevant to this evaluation were used to undertake the benefit-cost analysis in Chapter 5.

3. Economic Evaluation Framework

3.1 Overview

The Economic Evaluation Framework (the framework) defines the key elements that determine the economic costs and benefits of the asbestos management and removal options being considered (1, 2A and 2B). This section outlines:

- the approach to developing the framework
- key costs, benefits and assumptions that underpin the framework
- conceptual graphs that represent the way we have modelled asbestos management and removal options and their predicted costs and benefits to society.

The framework is compliant with the Commonwealth Economic Evaluation Guidelines (Commonwealth of Australia, 2006) and relevant supplementary guidelines (Department of Prime Minister and Cabinet, 2020).

The framework uses a modification to the national asbestos volume estimates from the Australian Asbestos Stocks and Flows Model' (stocks and flows estimate; Brown et al. 2023), that is, excluding asbestos cement piping. Option 1 considers the current ACM management approach using the modified stocks and flows estimates and is thus the 'baseline' to compare impacts of options 2A and 2B against. Option 2A and 2B impact stocks and flows estimates based on research (see Chapter 2) and stakeholder insights (see Chapter 4) into the impacts of proposals contained within the options.

3.2 Approach and terminology

The methodology for developing the framework is based on best-practice economic evaluation techniques as outlined in Australian Government economic evaluation guidelines. It relies on a wide range of sources to demonstrate how costs and benefits are expected to arise, and for whom, including qualitative and quantitative research, literature, expert interviews and existing datasets to create a logical underpinning for the analysis.

A cost–benefit analysis (CBA) is used to assess the impact of regulatory and policy proposals contained in the options on society. Where possible, these costs and benefits are represented in dollar terms and measure the change attributable to a policy proposal relative to the current baseline.

Principally, the national asbestos stocks and flows estimates are used as a key reference, along with findings and assumptions contained in the literature review and stakeholder consultation, as well as typical baseline assumptions. Furthermore, the methodology for the evaluation framework and model was presented to a broad panel of stakeholders in a workshop setting for feedback and refinement, which has been reflected in the analysis.

The results of the analysis are presented in net present value (NPV) terms using a nationally accepted 7% discount rate (Department of Prime Minister and Cabinet, 2020). A sensitivity analysis is also conducted, exploring the impact of changes in the discount rate and other key assumptions on the results of the model. Finally, significant qualitative social and non-financial outcomes are discussed.

Several economic terms are used throughout, as defined below:

- **Evaluation framework** – The overarching methodology for evaluating the asbestos removal options, relative to the base case. It formalises the logic surrounding the construction of an economic model, thus demonstrating how costs and benefits are likely to arise.
- **The model** – Refers to the economic model developed in Microsoft Excel to evaluate the costs and benefits associated with the proposals in the options. Within the model, the total costs and benefits of each option are evaluated and presented for comparison and reporting.
- **Benefits** – Refer to any positive impacts on society arising from the proposals, such as the improvement of health outcomes. They can be quantified or qualitative. The framework clearly defines the benefits evaluated within the model for each option.
- **Costs** – Refer to any negative impacts on society arising from the proposals, such as investment costs for the program. Like benefits, they can be quantified or qualitative. The framework clearly defines the costs evaluated within the model for each option.

- **Quantified costs and benefits** – These are costs or benefits that can have a dollar value placed on them through research, data or, if necessary, by using relevant and defensible assumptions.
- **Qualitative costs and benefits** – Costs or benefits that are unable to be quantified are described in qualitative terms. Practically, this means they are described rather than calculated. Importantly, an inability to quantify a cost or benefit does not imply irrelevance. Instead, extra care is taken to clearly articulate what the costs or benefit is, how and why it will occur, and what its likely magnitude is expected to be.
- **Discounted benefits and costs** – Discounting is a method for presenting future dollar values in today’s terms. Costs and benefits must be discounted to provide comparable numbers and to allow evaluators to make decisions more effectively. For example, a million-dollar government investment tomorrow will be comparably more expensive than a million-dollar government investment made in 30-years' time, given inflation, opportunity costs and so on. Discounting is used to control for these effects and allows all values used in the framework to be represented in 2023 dollars.
- **Discount rate** – This is the rate that future costs and benefits are discounted to reflect the time-value-of-money, as described above. A discount rate of 7% is often used for government proposals.
- **Net present value (NPV)** – An output of the model, expressed in dollar terms. A positive NPV of $20 million means that the policy proposal has delivered $20 million in benefits beyond the costs incurred. It is calculated as the sum of all discounted benefits minus the sum of all discounted costs.
- **Benefit–cost ratio (BCR)** – Delivers insight into the rate of return of any decision made, with a BCR of greater than 1 meaning for each dollar invested, more than 1 dollar of benefit is delivered, and hence a net benefit is expected to accrue to society. Conceptually, a BCR is defined as the sum of all discounted benefits *divided* by the sum of all discounted costs. A BCR of 2.5 means that a policy proposal is estimated to return $2.50 in benefits for every $1.00 invested.
- **Opportunity cost** – Some opportunity costs are explicitly calculated in the model; however, not all are captured. Therefore, it is important to keep them in mind when evaluating policy proposals. An opportunity cost is the intangible cost associated with committing to any economic decision at the necessary exclusion of all other possibilities. For example, the opportunity cost of investing in a public marketing campaign to raise awareness of the asbestos risks has an opportunity cost equal to the next-best alternative, such as an education program.

3.3 Asbestos risk control and removal options

The options being considered under this evaluation are:

Option 1 – The status quo

This option establishes a baseline for comparison to other options being considered. It evaluates the continuation of the existing policy and regulatory framework for the management, removal and disposal of ACMs.

Option 2A – Improved regulatory framework

This option proposes improvements to the existing regulatory framework for managing, removing and disposing of ACMs, to safely increase the rate of ACM removal by:

- amending WHS laws to
  - require asbestos management plans to include timeframes for removal based on risk, which duty holders are accountable for implementing
  - extend the ability for WHS regulators to issue prohibition notices in relation to ACMs installed prior to 31 December 2003 at workplaces (e.g. s197A Prohibited asbestos notices)
  - mandate asbestos awareness training and working with asbestos training for certain workers, consistent with occupations identified for mandatory training by WorkSafe ACT
  - lower the occupational exposure limit (OEL) in line with changes proposed by the European Directive (reducing from 0.1 f/cm3 to 0.01 f/cm3)
- Australian, state and territory governments develop and implement a prioritised ACM removal program for publicly owned and controlled properties

- improving the competency of asbestos assessors
- mandatory identification and disclosure of asbestos in residential properties at the point of sale and lease
- extending financial reporting obligations for businesses to include reporting asbestos liabilities in financial statements
- including the presence and condition of ACMs as a factor for rating the environmental and social governance of buildings
- restricting unlicensed removal of ACMs in relevant laws (e.g. WHS, Dangerous Goods, Public Health etc.)
- improving proactive enforcement and compliance activities.

This option assumes one or more of these proposals will be incorporated into the next phase of the Asbestos National Strategic Plan and subsequently adopted in all jurisdictions.

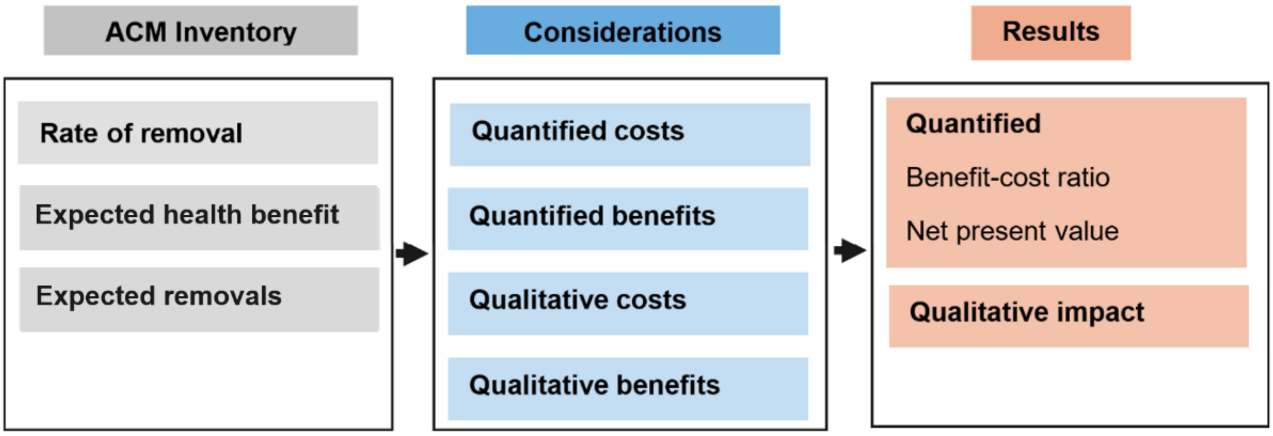
Option 2B – Incentives to support proactive asbestos removal

Option 2B builds on the proposal under Option 2A by including government incentives to further increase the rate of safe and proactive removal from commercial and residential properties, and to create value in the economy via improvements to public wellbeing, economic cost savings and other non-quantified improvements.

3.4 Components of the economic model

A wide range of components are modelled within the economic model to obtain an accurate estimate of the costs and benefits associated with each option. A summarised depiction of the configuration of the CBA is provided in **Figure 1**. Each of these elements is described below.

Figure 1. Summarised CBA model configuration



3.4.1 ACM inventory

As a start point the framework uses the stocks and flows estimates to establish the baseline ACM inventory. Each proposal in the options has been assessed against the following factors to determine its impact:

- the **rate of removal**, as the rate at which ACMs are estimated to leave the built form under each option
- the **expected health benefit**, which is the anticipated link between the changed regulatory environment, removal quantities and future health impacts
- the **expected removal rate**, which discerns between those removals that go as planned and are therefore completed at expected cost, and those that may encounter unexpected ACMs or deterioration beyond what was initially anticipated.

Ultimately, the goal of options 2A and 2B is that there will be a shift to proactive removal. Proactive removal refers to the removal of ACMs that are scheduled or prioritised using a risk-based approach. Where removals are timely, safe and at the expected cost they would be considered proactive. Reactive asbestos removal refers to removal of ACMs in an unscheduled or unprioritised way and occurs only after the ACM presents the risk of exposure to asbestos fibres, for example, by being left in place longer than is safe or removed because of unexpected finds, or when disturbed or damaged due to an unexpected or unanticipated event. As such, the risk of asbestos exposure is higher with reactive removals.

Benefits and costs will change based on the how soon, how safely, and how expected the ACM removal activity is estimated to be under each option being considered over time. The logical basis, and economic values underpinning these processes are expanded upon in Section 5.2.

3.4.2 Considerations and results

Quantified costs and benefits are outlined in **Table 7** (see Section 3.5) and are all related to the differences in the management and removal of asbestos, and how that impacts economic and social outcomes. Quantified costs and benefits will be computed to understand the total net benefit, as per Commonwealth Treasury Guidelines (2006). The total net benefit, as derived in the model and shown in NPV and BCR terms, will be used to evaluate the economic impact of each option discounted to real 2023 dollars. A range of qualitative costs and benefits, also outlined in **Table 7** are considered in the framework to better understand the holistic impacts and costs of options 2A and 2B.

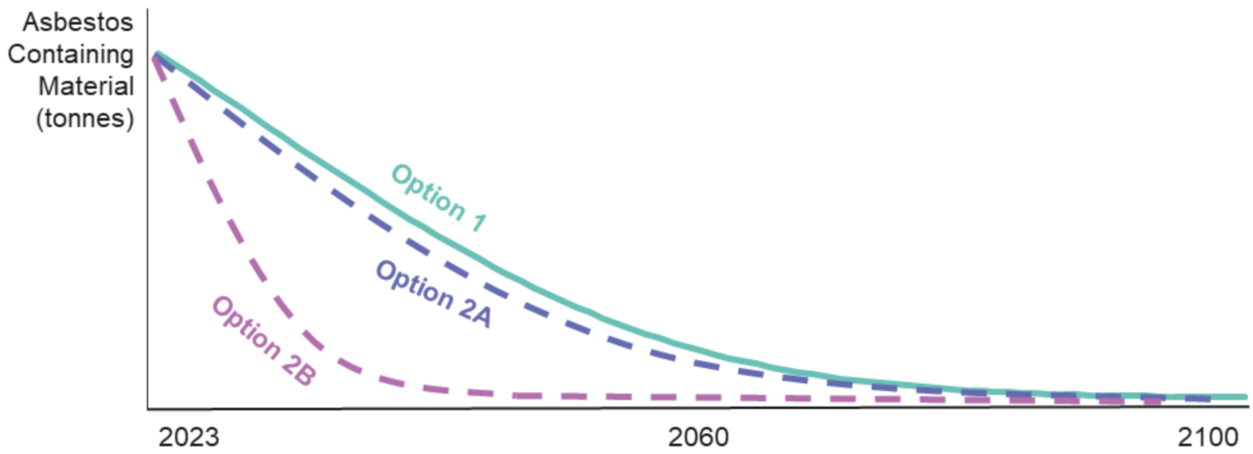
3.5 Modelling of asbestos stocks and flows

A range of conceptual graphs have been developed to demonstrate how the model analyses asbestos stocks and flows, and the net benefits arising from each option systemically. For example, the relationship between increased asbestos removal rate and the resulting net benefit to society are demonstrated. Limited labelling on the graphs axis is used to avoid confusion between the model concepts represented here and the modelling results in Chapter 5.

3.5.1 Estimates of asbestos-containing material stocks

Under each of the three options described in Section 3.3, the estimated ACM stocks in Australia will decline over time. This is a consequence of Australia's ban on asbestos mining, manufacturing, use and importation, combined with asbestos removal rates. What differs is the **rate** of removal, and this is used as the main determinant of the stock of ACMs in Australia over time. This relationship is shown in **Figure 2**.

Figure 2. ACM stock model

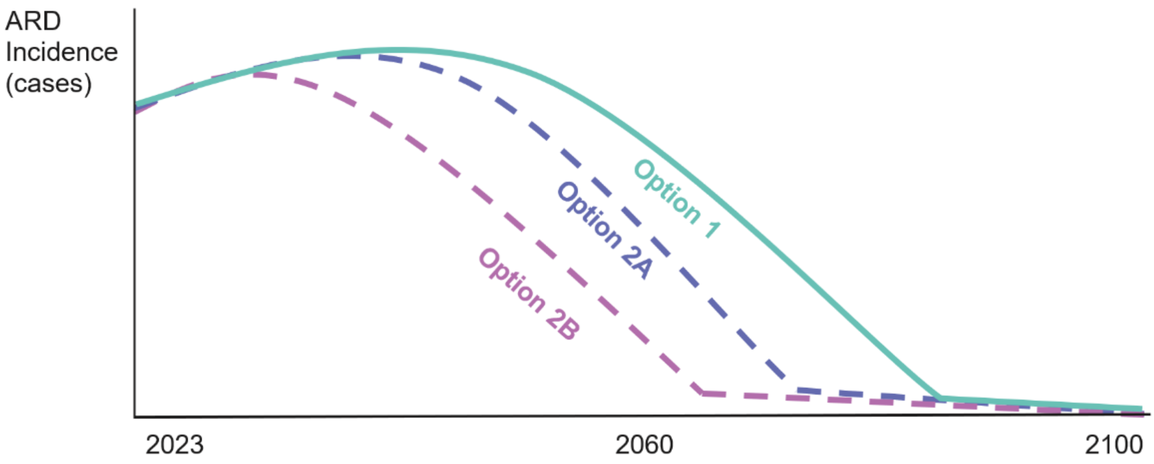


The anticipated decline in ACM stocks under each option can be seen in each line. Option 1 shows decline in ACM stock using the current in situ management approach. Under Option 1, it is anticipated that ACM stocks will decline to approximately 1 million tonnes by 2060 without significant intervention. Under Option 2A, a somewhat accelerated decline in ACMs is predicted due to improvements made to the regulatory framework over that period. Option 2B predicts a faster decline over the same period due to government taking a proactive role in stimulating removal via incentives schemes to businesses and individuals.

3.5.2 Asbestos-related disease burden

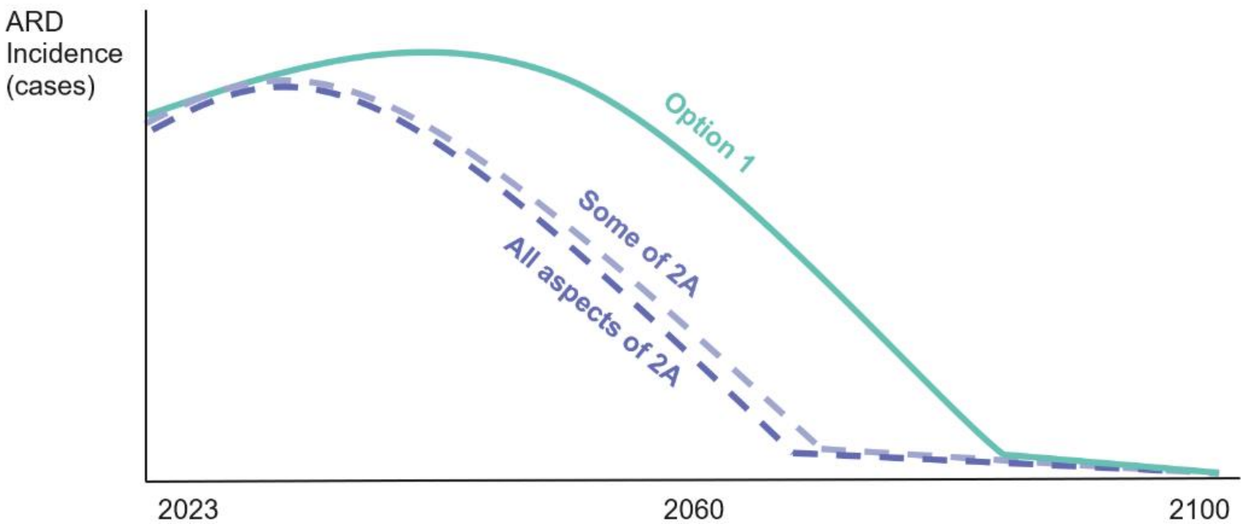
As demonstrated in the literature review, there is a clear link between exposure to asbestos fibres and the risk of developing an ARD. Higher ACM stock in the community increases the potential for ACM disturbance, elevating the risk of exposure and disease. Furthermore, there are fewer protections in the baseline for DIY removals and professions that may encounter asbestos, although would not be expected to frequently work with it. **Figure 3** and **Figure 4** demonstrate the way ACM stocks are expected to influence the incidence of ARDs in Australia over time.

Figure 3. Asbestos-related disease case load



Within both Option 2A and 2B, a range of complementary asbestos awareness raising, and WHS law improvements are proposed to be implemented to further reduce the risk of asbestos exposure. The additional impacts on ARD from adopting these proposals is shown in **Figure 4**, demonstrating how a coordinated response may improve overall health outcomes and benefits due to a reduced likelihood of reactive asbestos removal.

Figure 4. Impact of health and awareness campaigns



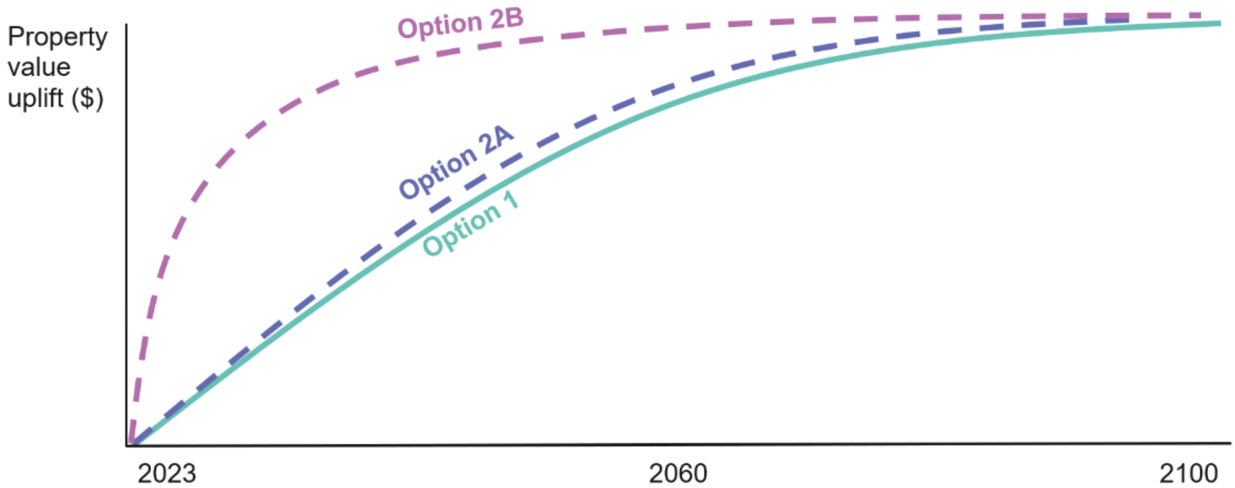
Based on the current in situ management approach, it is predicted that the rates of ARDs seen today are unlikely to be seen in the future. However, given that the latency period for mesothelioma can range from 20 to 60 years this is not yet reflected in the data. Because of this it remains unclear if the risk of asbestos exposure from legacy ACMs in the built environment are being effectively controlled by current practices (Mahoney et al. 2023). This is expanded upon in Section 5.3.

3.5.3 Property value uplift

It is expected that property value uplift will result from the proposals suggested under options 2A and 2B; however, this will be considered qualitatively. This notion builds on existing findings that ACM removal correlates with at least a $5 per square metre value uplift in rent on a property on average (Behrens and Tunny 2019). Both the literature review and stakeholder consultation have indicated a relationship exists between ACM removal and property value uplift; however, it is ambiguous about whether this is a transfer or an economic benefit.

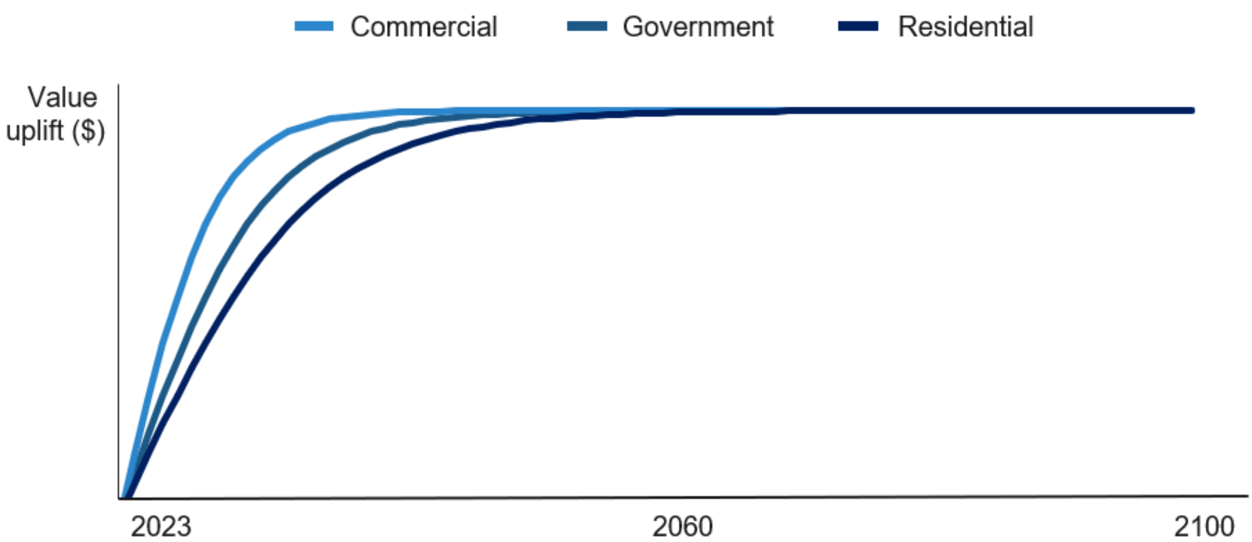
Figure 5 is a graphical representation of the expected relationship, where each removal increases the value of the asset from which it was removed. Under all options, all ACMs that can safely be removed will be removed from the built environment over the long term. Therefore, the same amount of value in the property will eventually be unlocked. As such, the key benefit comes from the accelerated realisation of that value. When future values are discounted to the present day, values nearer in time hold more value compared to those in the future. Hence, the difference between the baseline in Option 1 and the values in options 2A and 2B.

Figure 5. Property value uplift model



Asset type is not distinguished in **Figure 5**. However, as it is likely that property value uplift will differ across government, commercial and residential assets, **Figure 6** presents a more granular view of the relationship. Given commercial and government assets are used by multiple workers, stakeholders and customers, they produce more economic value. Hence, the value unlocked from increasing the removal rate is anticipated to be higher for commercial and government sectors than for the residential sector, except for higher density, multi-storey developments. These assumptions, tested in stakeholder consultation, provided a better understanding of the differences between asset classes.

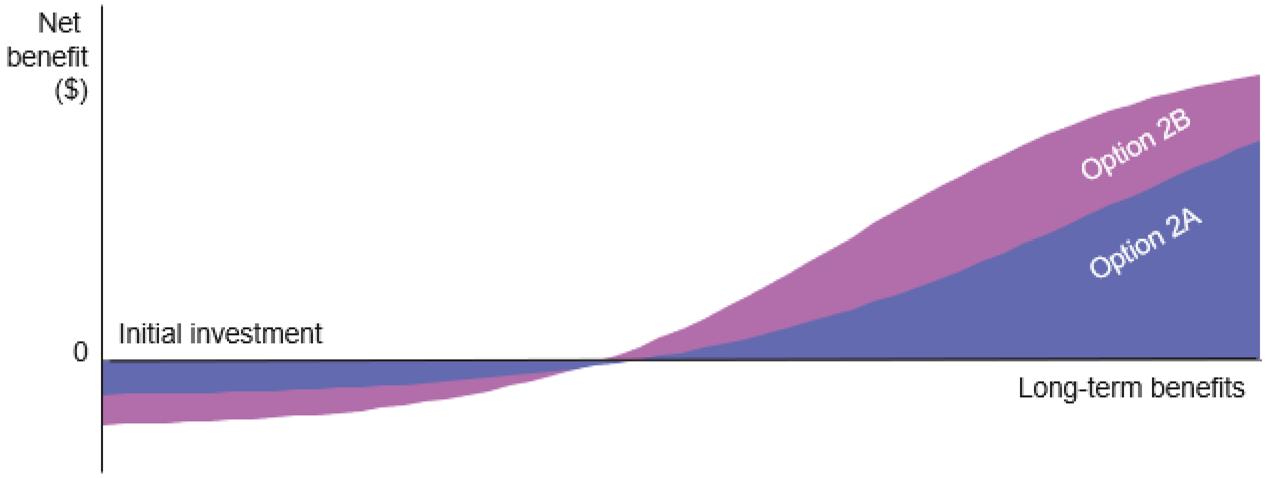
Figure 6. Property uplift by asset type



3.5.4 Costs and benefits

Figure 7 is a graphical representation of the anticipated cost and benefit profile of both options 2A and 2B against Option 1. It is anticipated that both the costs and benefits of 2B are greater than the baseline and Option 2A. Costs will be front-loaded while benefits will take time to realise, as impacts relate to long-term health and wellbeing outcomes.

Figure 7. Expected net benefits from option evaluation



The conceptual framework set out here is a high-level outline of the assumptions and principles that underpin the economic evaluation. Understanding of the behavioural responses to the proposals was refined through stakeholder consultation and best available literature and data to best capture efficacy, costs and the net difference in any new proposal above the current policy of in situ management. Analysis outputs and insights will be presented in Chapter 5.

3.6 Framework key costs and benefits

The literature review and stakeholder consultation have informed a list of the quantified and qualitative costs and benefits relating to options 2A and 2B. **Table 7** summarises these key cost and benefit considerations, which will be further discussed in Chapter 5, Cost–benefit analysis.

Table 7. Quantified and qualitative costs and benefits

Name	Description
Quantified costs	
Removal	The dollar and time cost of removal and transportation of ACMs will be calculated in each option and apportioned to the bearer of these costs. Costs vary depending on if removals see an unexpected cost.
Loss of asset use	ACMs in the built environment present a risk of exposure to asbestos fibres if the ACMs are damaged, disturbed or are deteriorating. At some point, the assets with ACM will be unable to be used due to these factors, or because of removal. This represents an opportunity cost to the users of the asset who cannot undertake economic activity while the risk remains. These costs will be captured in each option.
Waste management	The dollar cost of waste management will be calculated in each option.
Compliance and enforcement	Compliance and enforcement have both time and dollar costs for businesses and governments. Compliance and enforcement impacts both in situ management costs and removal costs. The framework will model the impact of relevant costs for training, compliance and enforcement requirements that are proposed. Baseline estimates and understandings have been built on data in Appendix 1, 2 and 4.
ARDs	The health benefits being assessed are irrespective of the health system costs of ARDs in Australia. The total cost difference due to ARD reduction will be calculated based on proposals in the options and will use research by the CIE (CIE 2018).
Government incentives	The cost of payments made by governments under Option 2B have been modelled.

Name	Description
Qualitative costs	
Government services costs and opportunity cost reductions	At some point, the requirement for government services will be phased out or significantly reduced. Due to significant policy uncertainty, the model will not consider cost reductions and reallocation of resources from this lower regulatory and staffing requirement. However, this is a cost that will reduce over the long term. It will also allow for substitution of resources into other compliance or funding activities, thus reducing the total estimated cost.
Quantified benefits	
Health improvement	The quality and increased length of life for Australians because of lower risk of exposure to asbestos and, therefore, lower rates of ARD. This is broken into the impact of an increased removal rate and improved regulatory and safety practice impacts.
Mitigated disaster costs	The impact of an increased removal rate and proactive removal on lowering the risk from disasters that lead to asbestos exposure events. This provides both a cost saving and ARD reduction benefit.
Other avoided costs	Literature demonstrates that there are a series of cost reductions that can be expected following improvements in the management and increased rate of removal of asbestos. This benefit will capture the avoided: ▪ costs due to a reduction in unexpected removal situations. This is because of improved assessor competence and regulatory changes to unlicensed removals. ▪ illegal asbestos disposal costs ▪ training, licensing and government staffing costs following complete ACM removal in Australia ▪ cost of asbestos management to businesses.
Qualitative benefits	
Insurance premiums on property	Economic benefits relate to the additional economic activity generated by an action or outcome. As insurance is a transfer of money, it is not an economic benefit. Instead, it has a distributional impact. There may be some reductions in the insurance on properties that once had ACMs but no longer, implying less property value risk to asset owners.
Reduction in legal dispute costs and payouts	Dispute payouts are a transfer of money, like insurance premiums and payouts. There is no direct creation or loss of economic value as a result. However, with the reduction in the risk of asbestos exposure, there will be less legal disputes, which will have both a personal mental health benefit for those involved and reduce undue costs within the economy.
Improved productivity from a healthier population	Healthier citizens are more productive. The benefit being considered relates to the quality and length of life from a willingness to pay perspective, which does not include the additional productivity resulting from improved health. Nonetheless, this will be a secondary benefit due to the reduction in the risk of exposure.
Improved productivity and increased development activity from less red tape	The property uplift value will capture the market value of removing the ACMs; however, it will not capture the property pipeline benefit as assets become more readily developable with the removal of regulatory burden.
Comfort and peace of mind from national removal	Concern about developing an ARD following potential exposure to asbestos fibres can result in psychological harm. While this harm cannot be quantified, there will be an improvement in quality of life for a large cohort of people due to peace of mind in knowing that the risk of asbestos exposure has been eliminated.
Corporate reputation	Proactive removal of ACMs will provide a benefit to corporate asset managers based on environmental, social, and governance (ESG) principals. Given this is an emerging area of practice and consideration, and ESG is not mandatory for reporting, this value will not be able to be qualitatively assessed.

Name	Description
Environmental benefits	Proactive removal of ACMs reduces the likelihood of land becoming contaminated. This reduced risk has both a cost reduction impact, which will be estimated, and an environmental impact related to an avoided loss of land.
Asset value	The property value improvement from proactive removal of ACM, based on the property type.

3.7 Impact of proposals

Individual proposals contained in options 2A and 2B will have their own effect on modelled outcomes within the economic evaluation. **Table 8** outlines the anticipated impact of each proposal and its broad effect on the model, and any qualitative impacts.

Table 8. Impact of proposals

Proposal	Model effect
Amendments of WHS laws	The combined suite of changes to WHS laws will place higher costs on businesses. However, it is anticipated that the impact of the changes will be to increase the rate of proactive removal of ACMs, resulting in health benefits from reduced asbestos exposure and increases in property value. There will be transitional costs, for example asbestos assessors and laboratories may need to upgrade equipment so that the lower airborne fibre threshold can be accurately measured, to improve safety and reduce exposure over the longer term.
Australian, state and territory governments committing to develop and implement a prioritised ACM removal program for publicly owned and controlled properties	This will increase the efficiency and effectiveness of ACM removal from government assets consistent with changes proposed to WHS laws above for all PBCUs. The increased removal rate will result in health improvements and property value uplift. The new requirements will come with increased costs of implementation.
Improving the competency of asbestos assessors	This proposal will increase ACM detection and make risk categorisation more consistent. This will reduce the number of unexpected finds and reduce the overall risk of exposure. This delivers benefits through health improvements, increased rate of removal and reducing unexpected costs of removal.
Mandatory identification and disclosure of asbestos in residential properties at the point of sale and lease	This proposal is anticipated to reduce the risk of unintentional exposure to asbestos fibres by property owners and tradespeople. Increased awareness is anticipated to result in health improvement and increased removal. This is expected to deliver benefits through health improvements, increased rate of removal and reducing unexpected costs of removal.
Extending financial reporting obligations for businesses to include reporting asbestos liabilities in financial statements	This proposal will aid in 'internalising' the costs of ACMs to the business, forcing businesses to account for and price asbestos liabilities. This is expected to deliver benefits through health improvements and increased rate of removal.
Including the presence and condition of ACMs as a factor for rating the environmental and social governance of buildings	This proposal will raise awareness of ACM for businesses and consumers. This is expected to deliver benefits primarily through increasing the rate of removal.
Limiting unlicensed removal of ACMs in relevant laws (e.g. WHS, Dangerous Goods, Public Health etc.)	This proposal will reduce the amount of ACMs handled by untrained people. This is expected to deliver benefits through health improvements and reducing unexpected costs of removal.
Improving enforcement and compliance activities	This proposal will increase the regulator cost due to resources required for improving existing practices. This is expected to deliver benefits

Proposal	Model effect
	through health improvements, increased rate of removal and reducing unexpected costs of removal.
Introduction of incentive schemes to encourage safe removal and disposal of ACMs from residential and commercial properties	This proposal will result in a transfer from government to households and businesses. This transfer will result in a cost to government which promotes the creation of value. This is value will result from increased removal rates, leading to health improvements, reduced latent risk of ACMs in the built form and reducing unexpected costs of removal.

The findings of the evaluation are presented in **Chapter 5**.

4. Stakeholder consultation

Urbis and ASEA conducted consultation to fill the gaps in knowledge about costs and benefits that were identified in the literature review. Insights, information and data was obtained from subject matter experts to build the evidence base for the evaluation, and to test the relevance and application of insights derived from the literature review.

4.1 Stakeholder consultation methodology

The methodology comprised four stages: scoping, participant identification, outreach and analysis.

4.1.1 Scoping

This stage involved identifying the key focus areas where data and information was still required to underpin assumptions in the CBA. Those were:

- risk profile of ACMs
- impact of asbestos on property values
- landfill capacity and costs of asbestos landfill
- workforce capacity, industry oversight and regulation
- environment.

4.1.2 Participant identification

This stage involved identifying the organisations and individuals that could provide the data and information within each focus area and determining the best mode of engagement selected for example, requesting data or interviews or a combination of both.

4.1.3 Outreach

This stage involved sending out requests to 21 organisations. These requests were primarily sent to federal, state, territory and local governments known to hold relevant data and information.

It also involved approaching individuals from 18 organisations to participate in a 30-minute interview to obtain contextual information, as well as testing the relevance of proposed options. Organisations approached included businesses and peak bodies with members who identify, remove and dispose of asbestos; universities; and government agencies that have implemented some of the proposals in the options. Interviews were conducted with a range of stakeholders from government and private sector organisations.

Urbis's internal expert panel for this project also provided their insights.

Appendix 3 lists the organisations that provided data and information or participated in interviews as part of stakeholder consultation activities.

4.2 Key Findings and analysis

This section summarises the findings from interviews and data/information requests and how these have been applied to the evaluation framework. It also outlines where data and information were not obtained and the gaps that remain.

Under each theme the following are reported:

- the organisations approached
- the type of data and information requested
- key finding and analysis of the data and information received from the interviews or the requests, including how the insights gained have been considered in the framework
- gaps remaining, where there was no response from target organisations
- assumptions made to address key gaps.

4.2.1 Risk profile of asbestos-containing materials

Organisations approached

- Peak bodies representing occupational health and hygiene professionals, asbestos assessors and removalists were approached for interviews.
- The WHS regulators in each jurisdiction, as well as the VAEA and the Northern Territory Department of Infrastructure, Planning and Logistics were approached for data and information.

Information requested and received

For the interviews the focus was on surveying for the presence of ACMs, in particular views on:

- the proportion of ACMs presenting a low, medium or high risk (i.e. the potential to release respirable asbestos fibres, necessitating removal) in buildings inspected
- the proportion of assumed ACMs later confirmed not to contain asbestos
- factors influencing whether an owner/manager decides to manage ACMs in situ or remove
- percentage of ACMs identified as high risk likely to be managed in situ
- policy shifts impact and incentives required.

Specific data requested from the WHS regulators were:

- on the characteristics of ACMs notified for removal where known, for example, estimated quantity and condition (friable/non-friable)
- the type of building the ACM was removed from (residential, commercial or government)
- risk of asbestos exposure at the site prior to ACM removal.

The VAEA and the Northern Territory Department of Infrastructure, Planning and Logistics were approached for data from their consolidated asbestos registers for certain government assets.

Additional information to better understand the proportion of additional ACMs discovered in an asbestos survey undertaken prior to renovation or demolition was sought in a second request to the VAEA and experienced occupational hygienists.

Tables 9 and **10** detail the information and data requested, the key findings and analysis.

Table 9. Interviews on risk profile of ACMs, key findings and analysis

Information requested	Key findings	Analysis
The proportion of ACMs presenting a low, medium, or high risk of releasing respirable asbestos fibres	Where ACMs are found, one interviewee estimated 10% would be assessed as higher risk when asked the proportion of low, medium or high-risk ACMs in buildings. They also noted this proportion has been reducing over several decades.	Interview estimate will be used with information from consolidated asbestos registers managed by government to inform costs and benefits in the model.
The proportion of assumed ACMs later confirmed not to contain asbestos	Of inspections, 90% would reveal ACMs. The proportion of assumed ACMs confirmed as not having asbestos when later tested is likely to depend on the competency of the assessor. The proportion of confirmed ACMs by building types is also related to the competency levels, specifically where experienced versus inexperienced are likely to be working on. Inexperience of assessors was given as one reason for overstating the presence of ACMs. Experienced assessors make more	Indicates a need for capacity building in the workforce for more consistent and reliable assessments to be made.

Information requested	Key findings	Analysis
	reliable assumptions about the areas affected.	
The proportion of assumed ACMs later confirmed not to contain asbestos	One occupational hygienist estimated up to 50% of assumed ACMs in domestic and commercial property may not contain asbestos. This was usually because sampling requires some damage to material, or to the inability of the assessor to access all parts of the property during the survey. Another occupational hygienist reported this may vary by asbestos contracting firm, noting some take numerous samples for testing whereas others present a lower cost option by relying on visual inspection only.	Validates options to improve assessor competency and contributes to understanding of avoided costs.
The proportion of assumed ACMs later confirmed not to contain asbestos	Occupational hygienists estimated between 20% and 30% of invasive asbestos surveys on domestic or commercial property reveal additional ACMs. This was partially attributed to access issues but also because invasive surveys are usually undertaken prior to renovation or demolition when the client requests higher accuracy for scope and budget of asbestos removal works. Other factors include poor research on the history of the building and under-appreciation of contamination from asbestos cement sheet roofing.	Provides a point of comparison to data from consolidated government asbestos registers presented in **Table 10**, showing 8% of verification inspections found additional ACMs.
Factors influencing whether an owner/manager decides to manage in situ or remove ACMs	Factors influencing removal include compliance with legal requirements, legal exposure, increased importance of a healthy workplace and damage found in ageing buildings. Stronger ESG standards for commercial organisations are resulting in commercial tenants increasingly demanding confirmation that buildings are asbestos free. As well as legal liability concerns organisations are increasingly driven to create social benefits, of which creating healthy workplaces is one example. Looking after employees' wellbeing is seen both as a duty and an organisational benefit. This trend shows organisations are expecting that the presence and condition of ACMs in buildings owned or occupied by them could become a future ESG rating factor.	Validates the approach to qualitative benefits in the CBA including improved productivity from a healthier workforce and corporate reputation. Validates that inclusion of asbestos reporting in financial or other reporting standards will have a material impact on removal rates.
Percentage of ACMs identified as high risk likely to be managed in situ	Older commercial and government buildings from the 1950s carry some of the highest risks of exposure, as do old warehouses in suburbs of capital cities partly due to the approach of spraying insulation fireproofing on metal beams and due to deterioration, that has exposed damaged pipework in ceilings. These warehouses are located on sites that are increasingly the subject of redevelopment and changing to residential use.	Confirms understanding that risk can vary by property type but does not provide an indication of percentage of high-risk ACMs remaining in situ.

Information requested	Key findings	Analysis
Policy shifts impact and incentives required	Incentives to encourage removal could be tax based. The ATO ruling TR 2020/2, which allows for income tax deductions for environmental protection activities expenditure, was identified as a policy that could encourage removal. However, there was a question raised about whether there is good awareness and use.	This is an example of an incentive that could form part of the options under 2B, and the modelling approach of incentives.

Table 10. Data on risk profiles of ACMs, key findings and analysis

Data requested	Data received	Analysis
Condition of ACMs notified for removal	Data was received from three WHS regulators on asbestos removal by condition (i.e. friable/non-friable) from notifications. As a proportion of total notifications in FY 2022–23, non-friable asbestos accounted for between 88% and 97% of removal works notified to the regulators.	The data shows non-friable ACM accounts for most of the removal works that informs the model. However, the complexity of removal works due to the condition of ACMs were not reported.
Class of asbestos removalists undertaking the work	Data was received from four WHS regulators on the class of removalist undertaking the work from notifications. The data shows there is significant variation between states relating to the engagement of Class A and Class B removalists. The proportion of all asbestos removal work undertaken by Class A removalists in FY 2022–23 varied from 83% in the ACT to 19% in South Australia.	This information will be combined with publicly available data on the number of licensed asbestos removalists and assessors (see Appendix 2) to inform the baseline and enable more accurate modelling of workforce changes required under options 2A and 2B.
The type of building the ACM was removed from (residential, commercial or government)	Data was received from four WHS regulators on building type breakdown of removal notifications. As a proportion of total notifications, domestic removal accounted for around: ▪ 83% in ACT where unlicensed asbestos removal is prohibited ▪ 88% in Queensland where additional training is required for DIY removal over 10 m^2 ▪ 55% in South Australia, and ▪ 36% in Victoria, where a comprehensive program of prioritised removal from government buildings is under way.	The data shows that while removal from domestic properties varies across jurisdictions, it typically accounts for most removal works. It is notable that the rate is higher in the ACT and Queensland where there are measurers to restrict unlicensed removal. This proportion of removal will inform modelling of removal rates, as well as apportioning of costs.
Condition of ACM removed	Data from removal notifications provided by three WHS regulators showed the condition of ACM removed: ▪ Victoria: 97.8% non-friable, 1.5% friable, and 0.7% both ▪ Queensland: 90.2% non-friable, 6.8% friable and 3.0% both ▪ ACT: 87.6% non-friable and 15.4% friable.	This proportion of ACM type will inform Urbis calculation of removal costs and apportion those costs across sectors.
Percentage of ACMs identified as high risk	Information from the Victorian consolidated register shows 8.9% of ACMs awaiting removal are rated most hazardous. These are mostly found in hospitals, fire services and train stations. The risk rating of ACMs in the Northern Territory consolidated register records	Informed the estimates in the model on the costs and benefits of managing or removing ACMs.

Data requested	Data received	Analysis
	approximately 3% of ACMs managed in situ are rated as high risk.	
Percentage of ACMs identified as high risk that are likely to be managed in situ	The Victorian consolidated government asbestos register shows 79% of all ACMs rated as most hazardous are currently managed in situ pending removal, while 21%, or 276 metric tonnes, have been removed.	Provides an indication of percentage of known high-risk ACMs managed in situ in the government sector.
The proportion of assumed ACMs later confirmed not to contain asbestos	The Victorian consolidated government asbestos register includes details of ACM presence verified with testing prior to removal. It shows that about 22% of assumed ACMs do not contain asbestos. Information from the Northern Territory consolidated government asbestos register confirms this. It shows around 26% of assumed ACMs are found not to contain asbestos when tested.	This data shows around a fifth to a quarter of material currently being managed by duty holders as ACMs may not need to be, validating options to improve assessor competency and contributing to understanding of avoided costs.
The proportion of additional ACMs found during subsequent/invasive survey	The Victorian consolidated government asbestos register showed verification testing prior to removal revealed previously unidentified ACMs. Of the total ACMs checked, approximately 8% were additional items discovered during the verification.	This information will be used to estimate unexpected finds that may increase the costs of removal work, noting information from occupational hygienists provided a higher estimate (20–30%) for domestic and commercial property.

Gaps and assumptions

There are gaps related to the percentage of ACMs identified as high risk but still likely to be managed in situ. No further light was shed on the finding in the literature review that in many instances ACM removal appears only to occur when as part of other building works, or in response to a disturbance or disaster event.

However, it was possible to gauge from notifications of asbestos removal work to WHS regulators that up to 5% of notifications are the result of emergency notices, and up to 15% of removals relate to friable material.

Data from consolidated registers and anecdotal reports from occupational hygienists indicates between 20–50% of assumed ACMs in asbestos registers may be found not to contain asbestos when tested. This informs modelling of avoided costs to maintain registers and management plans arising from proposals in Option 2A.

Furthermore, additional data provided by the VAEA suggests that 8% of verification inspections prior to removal work encounter unexpected ACM finds. Hygienists clarified that from their experience in residential and commercial sectors this is likely to occur more frequently, estimating 20–30% of inspections may miss ACMs during non-invasive surveys. This allows for informed assumptions to be made about the likelihood of unexpected ACMs during removal, with 20% unexpected removals assumed in the baseline.

4.2.2 Impact of ACMs on property values

Organisations approached

- An experienced practicing valuer specialising in industrial and commercial assets and an asbestos removal expert were approached for interview.
- One state government and one territory government that had conducted asbestos removal programs from residential properties were approached for data and information.

Information requested and received

For the interviews the focus was on how the presence of ACMs impact property values (residential, commercial and government) when selling or leasing. The focus was also on the time loss of using an asset during ACM removal and whether the removal of ACMs improve property value. Specific data was also requested on these matters. **Tables 11** and **12** detail the information and data requested, the key findings and analysis.

Table 11. Interviews on property value impact, key findings and analysis

Information requested	Information received	Analysis
How the presence or absence of ACMs impacts property values	Most buyers consider the presence of asbestos to be a cost for remediation or management of the site, and hence may pay less than market value or require a higher capitalisation rate to make a purchase. In this circumstance, price differences are a transfer of cost back to the seller, as opposed to an absolute difference in asset value.	Impacts on property value are evaluated qualitatively as there is ambiguity around the effect of asbestos removal on property values.
Time loss of using an asset during ACM removal	Times to remove ACMs vary and depend on the scope of works, accessibility and the adherence of the ACMs. An industry expert advised duration can range from: ▪ 5–7 days for removal of non-friable materials form a typical commercial office floor ▪ 7–14 days for removing a roof of a factory ▪ up to 7 times longer to remove friable materials.	Information on duration of removal works will be used to calculate time loss of using an asset.
Time loss of using an asset during ACM removal	In conversation with the VAEA (August 10, 2023), it was mentioned that their prioritised removal program worked flexibly, where possible, around business hours. They provided an example from the Victorian Schools Removal Program where removals undertaken during school holidays.	The loss of asset use will have a lowered impact on businesses and government services, as they will have some ability to work removals around operating hours.

Table 12. Data on property value impact, key findings and analysis

Data requested	Data received	Analysis
How the presence or absence of ACMs impact on property values	Information on the land value following loose-fill remediation and removal program in NSW was not available. In the ACT an increase in the resale value of land was significant and contributed to lower than anticipated program costs. However, the program closure evaluation did not apply values to the factors contributing to the increase.	This further validates and informs inclusion of property value as a qualitative benefit in the evaluation framework.
Time loss of using an asset during ACM removal	Average duration of removal works was provided by two WHS regulators. One regulator advised that asbestos removal notifications estimated the average duration of works at 41 days, ranging from 1 day to 760 days (based on 14,417 records and noting timeframes are indicative only as there may be a delay in closing jobs in the system). The other regulator estimated a sliding scale for duration by area ranging from approximately <100 m^2 1 day to approximately >2,000 m^2 up to 6 months.	Information on duration of removal works will be included in assumptions related to the cost associated with a building not being usable due to ACMs.

Gaps and assumptions

The stakeholder consultation was not able to put a rate or amount to changes in property value from removing ACMs. Without this data, an economic benefit cannot be calculated meaning proposed quantitative benefits from property value uplift will not be modelled. There was, however, sufficient nexus between ACM removal and property value improvements established in the literature review for property value increases to be included as a qualitative benefit.

Information related to the time loss of using an asset while asbestos is being removed varies. As a result, broad assumptions have been made related to removal times of individual commercial assets of 3 days for when work proceeds according to the scope of works and seven days when removal does not go as expected.

4.2.3 Landfill capacity and costs

Organisations approached

- Commercial and local government waste facility operators and peak bodies for waste management and resource recovery were approached for interviews.
- A Victorian Government agency working to a 10-year Asbestos Disposal Management Plan (Sustainability Victoria) which includes activities to confirm current waste capacity and future needs, and the Commonwealth Department of Climate Change, Energy, the Environment and Water were approached for data and information.

Information requested and received

Despite the making of multiple requests for interviews, no interviews were able to be arranged with the targeted organisations. This means that planned requests for data and information on landfill capacity and costs could not be put to waste facility operators or peak bodies representing industry.

Specific data was requested to augment the national assessment of hazardous waste infrastructure needs and capacities (Latimer 2022); however, the data on asbestos did not have sufficient coverage or completeness to inform quantitative analysis on capacity versus projections for asbestos waste.

Data and information requested of the Victorian Government agency included:

- current capacity (tonnage) available for asbestos waste
- capacity pressures and plans to meet demand in the future
- costs associated with establishing new transfer/temporary storage facilities and new long-term onsite storage facilities
- impact on asbestos waste disposal system caused by ACM removal programs, large construction projects, remediation works or disaster events.

Table 13 details the information and data requested, the key findings and analysis.

Table 13. Data on capacity and cost of asbestos landfill, key findings and analysis

Data requested	Data received	Analysis
Current capacity available for asbestos waste	No specific data received. Asbestos waste almost always goes into the general waste area of a landfill cell. It is immediately buried with 300 mm of cover and GPS coordinates recorded. This means landfill capacity for asbestos waste specifically cannot be reliably estimated.	Landfill capacity for asbestos waste needs to be considered in relation to all other waste streams going to landfill.
Capacity pressures and plans to meet future demand	In Victoria it was shown that some asbestos waste is transported up to 400 km from Melbourne. A pilot study on the use of additional transfer stations to accept and temporarily store asbestos waste before permanent disposal is being conducted.	Demonstrates that adequate landfill capacity within proximity to removal sites is a key requirement to support new policy options. Disposal capacity costs will relate directly to removal rate. The evaluation assumes that capacity becomes available when needed.

Data requested	Data received	Analysis
Impact of high peak volumes on asbestos waste disposal system	Sites which accept asbestos waste may be quarantined so they can service one project or removal program (e.g. Melbourne for the Victorian Schools Removal Program). This is prearranged to allow the project/program to safely dispose of large volumes of asbestos waste. Asbestos waste may also be transported interstate where there is more available capacity at the time (e.g. for disasters and extreme weather events especially where local waste facilities have also been impacted by flood/fire/cyclone etc.).	Waste disposal operates as a system both within and across jurisdictions. The model assumes that capacity comes online when needed.

Gaps and assumptions

The total capacity and anticipated future capacity of asbestos landfill facilities is not known, making qualitative assertions based on industry consultation for the hazardous waste infrastructure assessment (Latimer 2022) the most reliable information for this evaluation. As mentioned in the literature review, this report indicates capacity constraints for hazardous material waste across Australia is not significant. Thus, it is assumed that there is currently, and will continue to be, sufficient infrastructure to support increased removal activity.

With no input from waste facility operators, costs will need to be based on publicly available information; that is, the fees to dispose of asbestos waste from the Asbestos Waste Facility Database compiled by ASEA from facility websites.

4.2.4 Workforce capacity, industry oversight and regulation

Organisations approached

- Peak bodies representing occupational health and hygiene professionals, asbestos assessors and removalists were approached for interviews.
- The WHS regulators in each jurisdiction; state and territory government agencies responsible for implementing asbestos removal programs and asbestos training for trades and DIY removalists; local councils; and the Australian Government's Job and Skills Australia (JSA) were approached for data and information.
- JSA and the local governments were not able to respond within the evaluation period. ASEA continues to work with JSA to better understand the asbestos workforce.

Information requested and received

For the interviews the focus was on understanding the implications for the industry of implementing the proposals in options 2A and 2B, such as lowering the exposure standard to align with the EU decision and workforce competence and capacity.

Government departments were approached for both interviews and data/information on asbestos removal programs, licensing and training requirements. Insights were sought on:

- workforce, regulatory and cost implications of the initiatives, including any additional staff needed to ensure compliance and enforcement
- unexpected benefits or lessons learned from the initiatives
- data requested on asbestos notifications, such as the number of licensed removals works and estimated quantity of ACM to be removed by each licence class (see **Table 10**), for the jurisdiction was also used to understand workforce capacity.

Table 14 details the information and data requested, the key findings and analysis.

Table 14. Interviews on workforce capacity, industry oversight and regulation, key findings and analysis

Information requested	Key finding	Analysis
Implications of implementing proposals in options 2A and 2B	Industry organisations expressed concern about time and cost implications of introducing the lower exposure threshold to align with EU standards. This will be especially so if transmission electron microscopy (TEM) is required (about $800,000 each instrument). The estimated timeframe to train professionals to master the TEM is estimated at 10 years. The lower thresholds will also mean more samples will be needed over a longer period, therefore anticipated to result in higher sampling costs and delays to declaring sites clean and safe. One industry expert estimated per sample costs could increase from about $60 based on today's pricing to up to $500. New testing standards would have to be written, which are under the control of Standards Australia. These standards could take years to update.	The time for implementation will be factored into the model, noting that that a workplace exposure limit of 0.01 f/m^3 already applies to Class A friable asbestos removal work in Australia. We also note that the pace of regulatory change is a risk to the timeframes identified.
Workforce capacity to meet increased demand	One expert cautioned that the current workforce is inadequate to safely remove ACMs if removal rates are increased. Within the hygienist profession, capacity is already constrained managing business as usual and responding to review of workplace exposure standards would increase this strain. It was also noted that hygienist training duration ranges from 1 to 10 years depending on the level of qualification sought. The cost of training courses for assessors was raised as excessive and cost-prohibitive for some businesses. A review of current courses, costs and solutions to add more cost-effective training would be important to prioritise. A risk of price escalation for removal is also considered likely if incentives are offered to property owners. In turn this could encourage more removalists to enter the sector who will require skills training.	Confirms the importance of undertaking workforce training and capacity assessments. The time for changes to appropriate workforce and regulatory settings are assumed in the model phasing in options 2A and 2B over a defined number of years.
Workforce capacity to meet increased demand	Government stakeholders noted their experience when undertaking asbestos removal programs has been that industry will increase capacity to meet demand without a reduction in standards.	Demonstrates that government leadership can drive industry change, reinforcing the proposal for government commitment to safe prioritised removal.

Table 15. Data on workforce capacity, industry oversight and regulation, key findings and analysis

Data requested	Data received	Analysis
Removal programs	Information on costs to date of the NSW loose-fill asbestos buyback scheme were also provided, including outlay for asbestos inspections ($28.9 million for 71,213 inspections), communications ($1.1 million), property acquisition ($47.2 million for about 90 properties), structural demolition and site remediation ($20 million), and waste management ($7.99 million).	NSW figures inform costs of remediation programs to supplement publicly available information on the ACT scheme. The costs inform calculations of possible incentive schemes and of inspections and demolition works generally.
Workforce impacts	Data provided by the ACT afforded insight into the additional staff required by WorkSafe to ensure compliance and enforcement while the loose-fill	ACT figures have allowed for a case study of government staffing required to oversee the asbestos removal

Data requested	Data received	Analysis
	asbestos insulation taskforce and buyback scheme were in operation. This included administrative, management and regulatory inspector positions.	workforce. Workforce numbers, alongside their estimated pay, have allowed for a government workforce estimate to be included at the national level based on tonnes of asbestos removed.
Training	Data on the time, workforce, regulatory and cost implications of additional training for either DIY removals over 10 m^2 in Queensland or for mandatory asbestos awareness training for certain trades in the ACT were not obtained during the evaluation period. However, the ACT reported benefits including highly aware industry and public, leading to limited illegal asbestos disposal, a high rate of reporting illegal or non-compliant asbestos works, and efficient reporting of unexpected finds.	These findings relate to the mandatory training being proposed under options 2A and 2B. Benefits of training related to the safety and reduction in unexpected removal costs compared to the baseline will be included in assessment of the options.

Gaps and assumptions

A comprehensive mapping of workforce needs has not been obtainable for this current study. As a result, case study approaches from jurisdictions that did have data have been used to scale-up impacts. These scale-up assumptions are outlined in Section 5.4.4.

Assumptions on the number of people who would need to undertake the training have been made based on WorkSafe ACT's mapping to industries based on mandatory asbestos awareness and working with asbestos training, as no national mapping was available. Similar estimates were not possible for training in Queensland, as the courses are delivered to homeowners rather than industry.

4.2.5 Environment

Organisations approached

- Six individuals working across 5 organisations were approached for interview based on their specialist knowledge and expertise in public health, healthy housing, contaminated land and emergency management.

Information requested and received

Each interview was tailored to seek input relative to the expertise of the interviewee. All were asked for their opinion on the health and environmental impacts of in situ management of ACMs.

All insights relating to the environment focus were captured during interviews. The discussion points and their application to the framework are tabled below (**Table 16**).

Table 16. Interviews on environment, key findings and analysis

Information requested	Key findings	Analysis
Public health	Health impacts will be felt differently across groups in the community. Lower socio-economic households tend to bear a disproportional weight of the burden relative to other groups. This is because there is a higher proportion of low-income residents renting homes. Lower-priced rents reflect the condition of the property and are less likely to have been renovated to remove ACMs, or to be maintained to a good livable standard. Previous modelling of hazardous materials removal in homes, such as lead paint, showed that low-income households receive 6-fold health and wellbeing benefit versus 2-fold for higher income households.	Informs the approach to modelling the distributional impacts and gives further weight to treating asbestos impacts as a public health issue.

Information requested	Key findings	Analysis
Public Health	Two priority groups were identified for proactive removal efforts as issues of public health. The first was Aboriginal communities, particularly where living in poorly maintained house where exposure to asbestos is more likely. The other was urban communities where there are buildings that present an elevated risk of exposure if asbestos is released in an uncontrolled fashion such as a fire. For example, corrugated cement sheets found in old warehouses present a risk if there was a fire, and if severe has implications for potential exposure to the public.	Further informs the approach to modelling distributional impacts and may inform incentive scheme design in the model.
Health impacts	The extent of health impacts from exposure are not well understood since the effect of exposures today is not evident for another 20–30 years.	Confirms the assumption that health impacts are not evident for at least 20 years, and that current risk levels are different from historical, yet unknown.
Health impacts	Disability adjusted life years (DALY) in the GBD reports are an accepted measure of ARD impacts and are known and accurately quantify the level to which asbestos exposure causes a burden of disease from historical data. This was to predict the level to which the burden reduces over time.	Confirms chosen methods to establish the baseline and model changes to future health burden under options 2A and 2B.
Impact of disaster events Contaminated land	Negative air monitoring results at multiple sites following fires have shown that, depending on conditions, asbestos exposure is typically confined to the property footprint. However, exceptions do occur in a rare mix of high-risk conditions.	The model will need to reflect climate change impacts, making high-risk environmental conditions more likely, more often.
Impact of disaster events	Estimated costs of $100,000–$300,000 per demolition works for homes with ACMs, and an average time of demolition of 1–3 days each. Following the 2019/2020 bushfires 1,124 homes in NSW damaged in the fires and known to have ACMs were demolished.	Informs modelling of disaster event costs.
Impact of disaster events	Following a disaster event, the volume of ACMs that need to be disposed of can be extremely high. This means the best disposal options may not be the most cost effective or the closest. For example, during the cleanup in the 2019–2020 Black Summer Bushfires, NSW generated about 177,124 tonnes of asbestos waste. Costs to dispose of asbestos waste varied, as did the receptiveness of facilities to accept waste. In a flood environment the nearest landfill can also be under water which means waste must be transported to facilities further away, adding to transport costs. In the 2022 NSW Northern Rivers floods, a temporary transfer station was set up as an interim point between nature strips where waste was collected, and destination at a long-term waste facility. In total 2,053 tonnes of asbestos waste were processed at a cost of $733,422. This included servicing 265 registrations for kerbside collection of asbestos waste.	This demonstrates a need for surge waste capacity, proportionate to disaster risk be included in the model. Modelling will also need to factor higher volumes of asbestos waste, as well as higher transport and disposal costs.
Impact of disaster events	In a flood disaster the risk of asbestos exposure is lower when the ACMs are wet but can become an issue if disturbed or broken up and added to the general waste stream. For example, lack of awareness of safety and care required around ACMs in the Northern Rivers floods	Modelling will also factor higher volumes of asbestos waste, in recognition that damaged ACMs are more likely to contaminate the general waste stream during disaster clean-up efforts.

Information requested	Key findings	Analysis
	led to occurrences of contamination of the general waste stream as affected ACMs ended up in the household waste bins. Further separation was required at the transfer station where this occurred.	
Environmental sustainability burden	One of the public health experts considered ACMs to be an environmental sustainability burden if not removed due to propensity for it to be dispersed widely in disasters and extreme weather, single fires such as the Wickham Wool Store fire in 2022, activities such as high-pressure cleaning and illegal disposal. However, they cautioned that removal would only be supported if there is sufficient workforce capacity to ensure it is carried out safety.	Supports the position that proactive removal action can reduce future costs and health burden.
Contaminated land	One expert provided their view on how soil contaminated with asbestos can be remediated on site through deep burial, as experienced at Barangaroo.	Contaminated land issues will persist in the baseline because of poor past practices.

Gaps and assumptions

Some key gaps remain in relation to the environmental impact of ACMs in Australia. The extent of contaminated land has not been able to be quantified, and hence will not be included in the quantified analysis. However, the risk of climate change is a present issue for asbestos management and removal in Australia, therefore we have adopted the ‘asset at risk’ assessment for Australia at a medium risk level as being appropriate in relation to the risk of asbestos being released due to disaster events.

The cost of cleaning up asbestos-contaminated waste following disaster events has also been constructed using the data provided by NSW Disaster Management, as this was the only primary data available at time of writing.

5. Cost–Benefit Analysis

5.1 Evaluation of asbestos management and removal options

5.1.1 Methodology

A CBA has been used to provide an economic evaluation of the asbestos management and removal options in line with the framework outlined in Chapter 3. A CBA is the Australian Government's preferred evaluation method for estimating the costs of proposals, and the value created, to encourage better decision-making (Department of the Prime Minister and Cabinet, 2020). The CBA presented in this chapter provides a systematic evaluation of the impacts of the proposals under each option and accounts for all expected effects on the community and economy.

The CBA seeks to answer the question 'to what extent would a shift in policy from in situ ACM management to more proactive management and removal, consistent with the hierarchy of control, provide a net benefit to Australians?'. While every reasonable effort has been made to capture all data and information relating to the current and expected costs, impacts and outcomes of each option, it is not feasible to quantify all expected impacts. There are known gaps relating to asbestos in Australia, including exactly where ACMs may be found in the built form, the risk profile of the ACMs, and the costs of managing, removing and disposing of ACMs. As a result, some costs and benefits are difficult to estimate with precision. Clear and transparent assumptions and exclusions have been made to ensure the results of the modelling are defensible and can be replicated.

Due to the known data and information gaps, the total costs and benefits across Australia of each option are complemented with a comprehensive qualitative costs and benefits assessment. Together, the analysis of both qualitative and quantitative factors helps to better understand the expected overall impact.

5.1.2 Evaluation options

The options being evaluated are those outlined in Section 3.3. Option 2A and 2B are considered net of Option 1, as impacts are not expected to change in Option 1.

5.1.3 Key data sources

Several key data sources are used across the modelling under each option (see **Table 17**).

Table 17. Key data sources

Data Type	Purpose	Source
Blue Environment Stocks and Flows model	Modelling of baseline removal of ACMs from the built form, including ACM product types and when they are typically removed.	Brown et al. (2023)
Literature review	An overview of research and other literature on asbestos in Australia.	Multiple sources
Stakeholder consultation	Detail of modelling impact provided in Section 4.2.	Multiple sources
ARDs	Modelling the health system cost impacts of ARDs, and hence any cost reductions from the proposed options 2A and 2B.	Multiple sources
Deaths, burden of disease and incidence of ARDs	Modelling the Disability Adjusted Life Year (DALY) impacts of ARDs, and hence any avoided DALY impacts from the proposed asbestos management and removal options.	GBD Compare and GBD Foresight tools, The institute of Health Metrics and Evaluation, University of Washington (IHME 2020)
Elements of avoided cost from ACM removal	Areas of avoided cost from removal of ACM in Australia, including estimates of costs.	Discussion Paper: Return on Investment to enable Safe Prioritised Asbestos Removal in Australia (Behrens and Tunny 2019)

5.1.4 Key assumptions and exclusions

Assumptions

This CBA uses a range of key assumptions to inform the model (see **Table 18**). These assumptions impact the entire model and the overall analysis. A notable change to convention is the extension of the evaluation period from the usual 30 years to 78 years. This change is necessary to capture the delayed health benefits of options 2A and 2B, as well as to allow a comparison to the baseline estimate of when most ACMs are forecast to be removed, in 2100.

Table 18. Key assumptions

Assumption	Value	Source
Base year	2023	Convention
Discount rates	4%, 7%, 10%	Department of Prime Minister and Cabinet (2020)
Evaluation currency	AUD (2023)	Convention
Evaluation period	78 years	In agreement with ASEA to capture the baseline removal timeline
Region of economic impacts	Australia-wide	As per economic evaluation framework
Sectors	Residential, Commercial, Government	As per economic evaluation framework
Incubation period for asbestos-related disease	30 years	Literature review, Urbis modelling
Increased removal rate – 2A	0.6% year-on-year	Literature review, Urbis modelling
Increased removal rate – 2B	1.0% year-on-year	Literature review, Urbis modelling

Exclusions

Several exclusions were also necessary for the model, as shown in **Table 19**.

Table 19. Key exclusions

Exclusion	Description	Impact
Asbestos cement piping	Excluded given concurrent work on policy in this space.	ACM estimates are a subtotal of all ACMs that will leave the built form.
New technology	The impact of innovative technologies related to identification and disposal of ACMs and treatment and cure of ARDs.	This analysis is a point-in-time estimate of the impacts arising from the current state of technology.
Policy uncertainty	The model does not include specific jurisdictional distinctions in relation to the policy and legislative approval process.	It is assumed that policy makers and stakeholders act in good faith to implement options 2A and 2B. Policy delays will change the envelope of benefits and costs.
State or region-specific considerations	This analysis is conducted at the national level.	Estimated national impacts will not be evenly distributed, as ACMs are not distributed evenly across Australia. Furthermore, some jurisdictions will experience different cost and benefit envelopes depending on how significant policy and regulatory changes are to their jurisdictional context.
Asbestos-contaminated waste	The total estimated waste for this analysis relates to waste that contains asbestos. Jurisdictions across Australia have differing thresholds to determine if waste is asbestos waste, and hence the total volume of waste with asbestos contamination will be larger than that estimated within this analysis.	The total quantum of waste generated will be underestimated within this model. This difference is smaller under options 2A and 2B where mixed asbestos-contaminated waste is anticipated to be lower because of proactive removal.
Imported and exported products with ACMs	This analysis is limited to ACMs that were in situ when the 2003 ban was imposed.	The impact will be negligible compared to the legacy volumes.

5.2 Asbestos-containing materials removed under each option

5.2.1 Baseline estimate

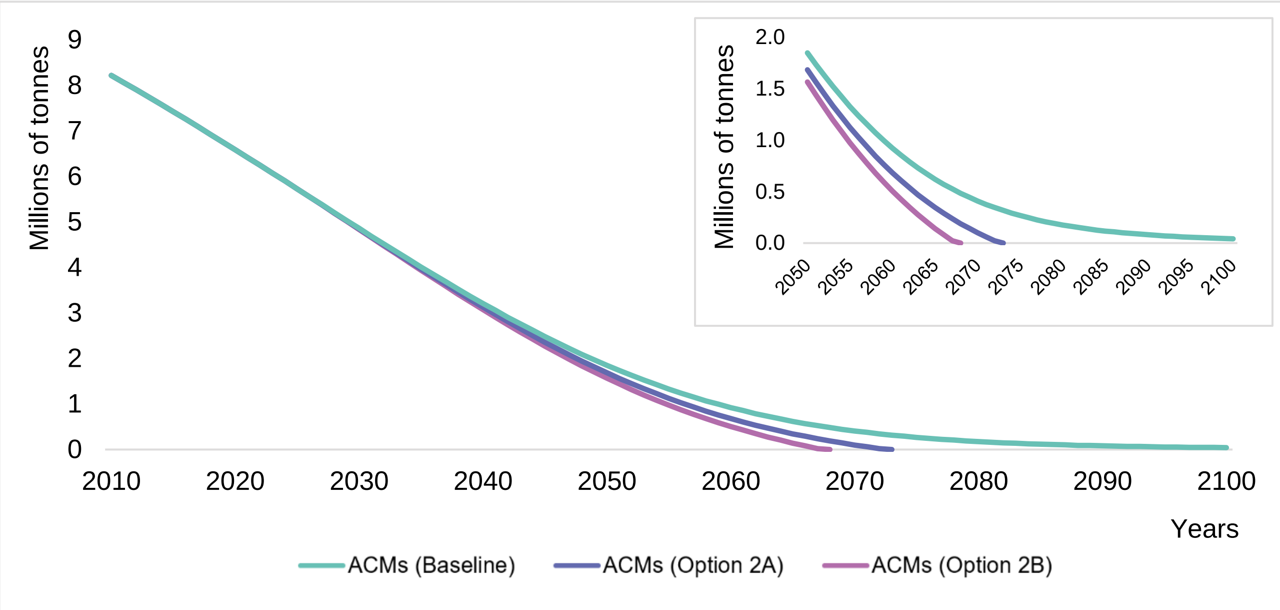
Option 1 establishes the baseline for comparison to other options, evaluating the 'business as usual' removal that can be expected with the continuation of the existing policy and regulatory framework for the management, removal and disposal of ACMs. The stocks and flows estimates have been built on and refined by using Australian, state and territory government data, industry data and expert information and input. The only modification to the stocks and flows estimates that has been made for this evaluation is the exclusion of asbestos cement piping.

5.2.2 Removal under options 2A and 2B

Options 2A and 2B drive an increased rate of removal of ACMs from the built form. These are the direct result of an improved regulatory and policy environment, as well as incentive payments provided. Predicted removal rates shown in this section, and underpinning the evaluation, apply to the full suite of costs and benefits within the model. The cumulative impact of proposals under 2A and 2B (defined in Section 3.3) on removal rates has been estimated. This shows a 0.6% year-on-year increase in removal for 2A and a 1.0% year-on-year increase in removal under 2B.

Each proposal has an impact on the rate of removal estimated. These rates are sensitivity tested in Section 5.8. The rate of removal ramps up, with the full impact of proposals anticipated by 2029, or 5 years after the assumed full commencement of the proposals in 2024. Both the year-on-year increase in removal and implementation timeframes were refined through a workshop between ASEA and Urbis, which resulted in the setting of conservative timeframes for implementation. The year-on-year increase could be higher if proposals were implemented expeditiously or if governments, businesses and individuals respond more actively to the proposals. **Figure 8** graphs the estimated total ACM stock across Australia under each option.

Figure 8. Estimated Australia-wide ACM stocks from 2010, by option



Source: Brown et al. 2023, Urbis 2023

In the baseline estimate, it is assumed that a small level of ACMs remains in the built form in 2100.

Under Option 2A, the increased rate of removal sees all ACMs leave the built form by 2073, resulting in a total of 322,746 tonnes of additional ACM removed compared to the baseline. This represents an additional 5% of the current ACM stock being removed by 2073 under Option 2A.

Under Option 2B, all ACMs leave the built environment by 2067, which is estimated to involve removal of an additional 504,000 tonnes of ACM over the period. This is equivalent to 8% of total ACMs currently estimated to be in the built form.

5.3 Asbestos-related disease burden under each option

There is a significant body of research linking asbestos exposure to a range of life-threatening and debilitating diseases, as outlined in the literature review. The literature review also detailed the current and potential future impacts of the ACM legacy in Australia. However, it also showed there is a knowledge gap in the literature on the impact of current asbestos exposures on the anticipated future health incidence and burden in Australia.

Therefore, historic data and international best-practice forecasts have been evaluated to develop a health model demonstrating how more proactive ACM management and removal can lower ARD incidence and burden through to 2100. To adequately capture the impact of the options, this health model considers how earlier removal of ACMs can reduce the future health burden of ARDs.

5.3.1 Time between exposure and asbestos-related diseases onset

A regression analysis was undertaken that evaluated ARD incidence, death, and disability adjusted life year (DALY) data from 1990 to 2019, with data obtained from the GBD Compare Tool (IHME 2020). This confirmed the estimated latency in ARD onset noted in the literature review (see Section 2.4.1), with a time lag of 30 years for ARD incidence, deaths and DALYs yielding the most statistically significant result; incidence had a slightly more significant result for 31 years. This means that the strongest estimated causal relationship to these outcomes is the quantity of ACMs exiting the built form 30 years prior.

Outputs of the statistical model were then compared to estimates of deaths from the GBD Foresight tool, which uses best available research to obtain estimates of deaths in Australia to 2040. The long-term forecast trend was derived and extrapolated using a least-squares method through to 2100, and then compared to the results of the regression model above. Comparison of results yielded a net difference of less than 5% on average. As raw data relating to the GBD Foresight tool was not available, an average of estimates using GBD Foresight, and the regression model was adopted as the baseline estimate.

As noted in the literature review, due to the lag between asbestos exposure and health impacts on individuals, there is no research to date that predicts the future health burden of ARDs based on asbestos exposures occurring today. Predictive models assume the historical relationship between asbestos exposure and ARD incidence can predict future health burden. This is despite considerable improvements to public health, WHS and environment protection laws in Australia which aim to prevent exposure to asbestos fibres.

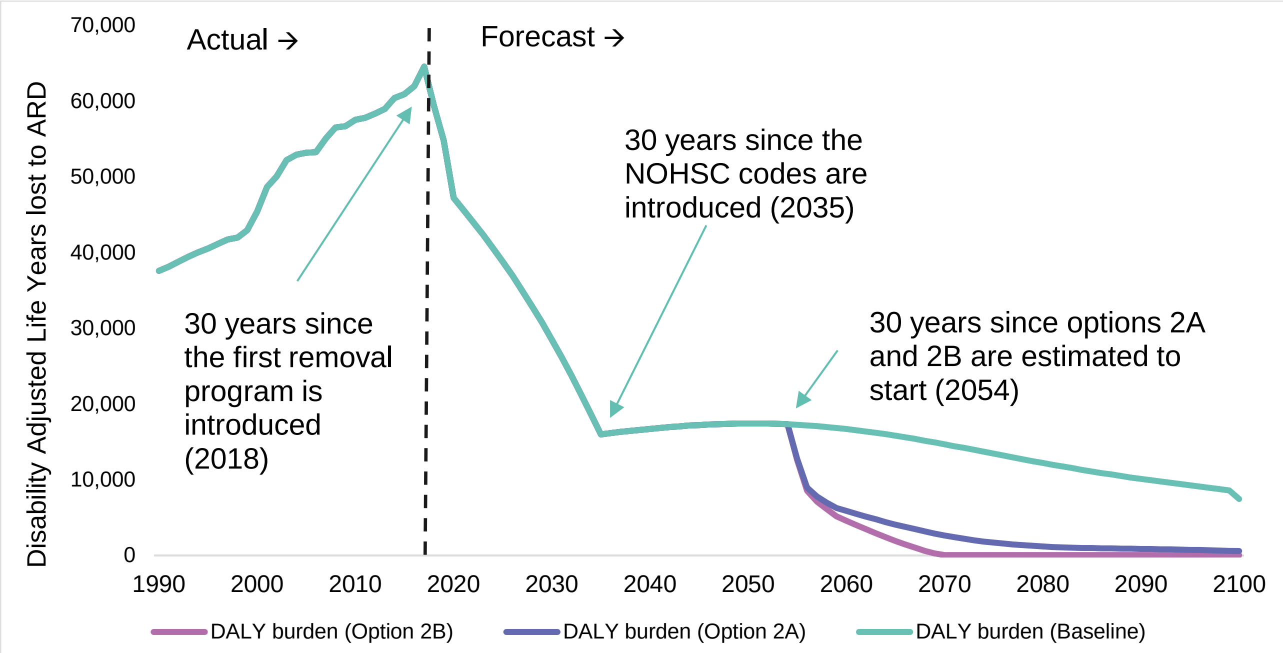
To ensure that estimated impacts are not overstated, a deflator has been applied to the baseline relationship between removal quantities and health impacts. The deflator assumes that between the time of the first loose-fill asbestos insulation removal program in 1988, and the introduction of the first nationally consistent safety rules – National Occupational Health and Safety Commission (NOHSC) codes in 2005 – there has been an 80% reduction in the risk. Over the evaluation this is assumed to remain constant in the baseline as, while it is acknowledged that the ongoing deterioration of ACMs may increase the risk of ARDs developing, the regulatory and removal environment decreases this risk in equal measure.

While literature notes that the nature of exposure has shifted towards more non-occupational exposure, no distinction has been made between the occupational and non-occupational setting. This is because the lines between occupational and non-occupational settings are not always clear.

Under the proposed options, this latent risk is further reduced to 9.5% of the original health impact. By reducing the forecast ARD burden in this way, this health model implies that the risk of a 'third wave' of ARDs as discussed in literature since 1990 (summarised in Mahoney et al. 2023) can be eliminated. This reflects the fact that a prioritised, risk-based approach alongside workforce skills and regulatory improvement further reduces the quantity and risk profile of ACMs in the built form.

Figure 9 summarises the ARD burden in the form of DALY estimates under the baseline, as well as options 2A and 2B. The dashed vertical line in 2019 is the limit of available data; data following 2019 is modelled.

Figure 9 Estimated disability adjusted life years (DALY) burden under each option



Source: GBD Foresight, Urbis Calculations

5.4 Quantified Costs

5.4.1 Removal

Increasing the rate of ACM removal in Australia

Removal costs will change compared to the baseline due to the increased rate of ACM removal under options 2A and 2B. Two key changes have been identified and modelled:

1. Total removal costs increase on a per-year basis because of the increased rate of ACM removal.
2. There are 'to be avoided costs' under 2A and 2B due to a lower proportion of unexpected removal costs, as modelled in Section 5.5.3.

Additional avoided costs associated with earlier removal and arising from a reduced compliance burden of no longer managing ACM in situ are also discussed in Section 5.5.3.

The increase in removal activity is modelled as the difference between options 2A and 2B, and the baseline. Costs are assumed to differ based on whether removals are undertaken 'as expected' or incur 'unexpected' costs. Unexpected costs arise when ACMs are found that were not previously identified in a management survey, or other identification events occur during removal, causing a delay or change to the planned removal works and other associated works. While stakeholder consultation indicated that unexpected removals are relatively common, data availability is poor, particularly in the residential space.

It is anticipated that improvements in regulation and workforce capacity will have a significant impact in reducing the incidence of unexpected cost events. Costs considered in options 2A and 2B have been determined based on best available literature, stakeholder consultation, and the modelled increase in the rate of removal as outlined in Section 5.2.

Assumptions

A range of assumptions have been adopted to model the removal costs under options 2A and 2B (see **Table 20**).

A key assumption for the cost base relates to the proportion of ACMs assumed to be removed at expected cost, and the proportion removed with unexpected cost in the baseline. It is noted that there is little data in relation to these costs, so expected and unexpected cost assumptions have been estimated from reported costings and cost changes captured by the VAEA, with supplementary commentary from occupational hygienists with experience in residential, commercial and government sectors. Unexpected ACM removals are estimated to occur 20% of the time, on average, although it was noted that this changes significantly based on the age of ACMs, the type of building, the quality of inspections done in the past and the number of samples tested. This is higher than the 8% of unexpected ACMs discovered during VAEA removal programs; however, is in line with qualitative and other notifications data which indicates rates above 20%, particularly in the residential space.

Improved competency of assessors and better asset management practices from PCBUs is expected to have a material impact on the proportion of removals where an unexpected ACM is discovered. This is anticipated to result in more accurate assessment, which will decrease the rate of unexpected finds. Overall, it has been assumed that this leads to a reduction in unexpected ACMs removal of 7% under 2A and 2B.

This assumption is likely to be an underestimate of the total rate of unexpected costs in the baseline. These are the only known and quantified elements available for this evaluation. Furthermore, costs are not related to the risk profile of the ACM stocks being removed, but rather the average outcomes of removal practices. There will be outlier events that have significantly larger cost implications for unexpected ACM finds that cause major project delays.

Table 20. Asbestos removal cost assumptions

Assumption	Value	Source
ACMs removed under expected conditions (baseline)	80%	Average proportion of expected removals reported through Stakeholder consultation.
ACMs removed under unexpected conditions (baseline)	20%	Average proportion of unexpected removals reported through Stakeholder consultation.
ACMs removed under expected conditions (2A and 2B)	87%	Assumption developed with ASEA: anticipated because of the improved competency of assessors and better asset management practices from PCBUs.
ACMs removed under unexpected conditions (2A and 2B)	13%	Assumption developed with ASEA: anticipated because of the improved competency of assessors and better asset management practices from PCBUs.
Removal cost per square metre	$100	Literature review, Stakeholder consultation.
Increase in cost of unexpected removal	20%	Literature review, VAEA cost data (confidential).
Square metres per tonne of ACM	109 m^2	Urbis calculation based on median weight of 9.2 kilograms per square metre of asbestos cement roofing (NSW EPA and Shoalhaven City Council, 2015).

Results

Increased removal costs and avoided costs presented in this section are less any support provided by government incentives. This means that Option 2A sees a higher cost to 2B, where government incentives cover a proportion of the costs. This is to avoid double-counting of government incentives provided within 2B. The following results demonstrate that costs of removal are significant under both 2A and 2B. Compared to Option 1, 2A accrues a real increase in costs of $778 million between 2023 and 2073 when all ACMs are predicted to be removed. In comparison, 2B accrues a real additional cost of $689 million over the period between 2023 and 2068 when all ACMs are predicted to be removed. Results are shown in **Table 21**.

Table 21. Total additional removal costs, discounted 2023 dollars

Calculation	Option 1	Option 2A	Option 2B
Nominal	$0.0m	$3,599.3m	$3,566.4m
Discounted	$0.0m	$778.0m	$688.7m

5.4.2 Loss of asset use

Accounting for the costs to business from ACM removal activities

ACM removal may require asset owners to vacate part, or all, of a premises for the removal period. This presents a cost to all occupiers, but particularly to businesses, who will not be able to trade through their physical stores or undertake productive work for the period of removal.

Residential occupancy is excluded as it does not typically contribute to economic production. Urbis has assigned ACM proportions to either residential, commercial or government buildings (Appendix 4, Table 68), resulting in an estimated majority (58% in 2023) of ACMs remaining in the built form being in residential assets. As a result, the level to which loss of asset use will cost the economy is reduced.

Loss of asset use quantifies the lost revenue or productivity of an asset while asbestos is being removed. Data related to the time of building closures was sourced from removal notifications, which has yielded a broad time band related to ACM removals. The days lost of asset use has been multiplied by the average daily wage and the number of anticipated workers impacted across government and commercial assets. It is assumed that some removals can be scheduled out-of-hours so as not to cause disruption to operations. It is also assumed that consumers and workers can substitute days lost to avoid overestimating this loss.

Further to this, the net difference between loss of asset uses under each option as compared to the baseline due to a reduction in unexpected changes to removal has been calculated.

Assumptions

A range of assumptions have been adopted to model the costs of lost asset use under each option (see **Table 22**).

Table 22. Loss of asset use cost assumptions

Assumption	Value	Source
Proportion of ACMs in commercial and government buildings (2023)	42%	Blue Environment Stocks and Flows Model (Brown et al. 2023) with Urbis calculations based on distribution in Appendix 4.
Square metres per worker	14 m^2	Department of Treasury and Finance floorspace utilisation target (Department of Finance 2023)
Workers impacted per tonne of ACM removed	7.8 FTE	Urbis calculation using the square metres per worker (above) and square metres of ACM per tonne (Section 0)
Days lost per proactive removal (upper bound estimate)	3	Urbis calculations based on data requests
Days lost per reactive removal (upper bound estimate)	7	Urbis calculations based on data requests
Proportion of removals that will be scheduled outside of work hours	50%	Urbis assumption, based on VAEA discussion
Average daily income per worker	$368	Based on ABS – Average Weekly Earnings, May 2023 (ABS 2023a)

Results

As shown in **Table 23**, the cost of lost asset use increases directly in line with the removal rates assumed under each option. As more ACMs are removed earlier in Option 2B, costs are experienced earlier. With an estimated cost of $178 million in Option 2A, and $298 million in 2B, there is an estimated net difference in lost asset use costs of $120 million. There are additional considerations related to which type of business will be most impacted. Notably, this cost will be relatively more acute for those businesses with small margins, or where there are unexpected ACM finds.

Table 23. Total additional loss of asset use costs, discounted 2023 dollars

Calculation	Option 1	Option 2A	Option 2B
Nominal	$0.0m	$945.1m	$1,426.0m
Discounted	$0.0m	$177.9m	$297.7m

5.4.3 Waste management

Accelerating waste management costs under each option

The literature review shows that it is reasonable to expect additional capacity and infrastructure for the disposal of ACMs will be adequately provided under options 1, 2A and 2B, even with increased rates of removal. It is assumed that there is currently, and will continue to be, sufficient infrastructure in well-located areas, to support increased removal activity. Furthermore, proactive removal of ACMs sees as little as 1% of hazardous waste tonnage going to landfill compared to mixed contaminated waste. As a result, the evaluation does not consider any additional infrastructure needs under any option. Hence, the costs considered relate to increased management costs due to increased rates of asbestos waste going to landfill.

The cost of additional waste management at each site has been considered. A lack of available data means that the true cost of waste management, which would include operations and maintenance staff and any additional capital works could not be sourced for this analysis. Instead, costs of waste management have been calculated on a per-tonne basis through costs collected within ASEA's asbestos waste facilities database, updated July 2023 (ASEA 2023b). Average charges have been provided for each state/territory and apportioned based on the volume of ACMs in each jurisdiction. The weighted average cost of waste management was estimated to be $443 per tonne. Any estimated acceleration of ACM tonnage entering waste facilities will bring forward waste management costs. Subsidising of waste management costs mean some jurisdictions will have artificially low estimates.

Assumptions

The central cost assumption used to model waste management costs is presented in **Table 24**.

Table 24. Waste management removal cost assumptions

Assumption	Value	Source
Management cost per tonne	Weighted average – $443	Asbestos Waste Facilities Database, with Urbis weighting based on volume of ACMs in each jurisdiction

Results

As shown in **Table 25**, there is an estimated small additional cost to the economy under both options 2A and 2B for waste management. Overall Option 2B attracts an estimated additional cost of around $21.3 million compared to 2A. This is relatively minor compared to other costs. Costs may be significantly higher if a poorly coordinated approach is taken in relation to capacity and availability in local catchments. Furthermore, costs related to waste management staffing were not able to be captured for this evaluation, and hence this is likely an underestimation of total waste management costs.

Table 25. Total additional waste management costs, discounted 2023 dollars

Calculation	Option 1	Option 2A	Option 2B
Nominal	$0.0m	$143.1m	$223.5m
Discounted	$0.0m	$30.9m	$52.2m

5.4.4 Compliance and enforcement

Investing in the future safety of the community

Both options 2A and 2B will trigger additional compliance and enforcement activity across each jurisdiction. This may require capacity building with associated additional costs for government staffing, workforce training and licensing. The cost of compliance and enforcement activities will impact governments and businesses and be specific to the jurisdictions in which ACMs are being removed; however, the results presented in this section are at the Australia-wide level.

Assumptions

A range of assumptions have been adopted to model costs under each option.

The data on compliance and enforcement from WorkSafe ACT was particularly rich, making it a useful case study for estimating requirements nationally. The data outlined the staff required by the ACT Government to secure compliance with WHS laws in the territory. Using the workforce numbers provided, alongside the estimated ACM stock removed in 2022, gives an estimate of the required full-time equivalent (FTE) staff by job type, on a per tonne basis. This was then scaled to a national level, and total workforce needs are based on the implied workforce required to support ACM removal. Given the smaller geography of the ACT, a staffing premium has been assumed to capture the increased need for staff in rural and remote areas, as well as in jurisdictions with smaller compliance operations than those currently in the ACT. As the quantity of

ACMs removed each year increases, the workforce required by government to oversee operations also increases accordingly.

Additional to government capacity building; training and licensing costs for asbestos removalists and assessors will increase under options 2A and 2B. A similar approach has been taken to understand the impact of the options from this perspective. National numbers of licences, by type and state have been collected through the literature review. The costs of these licences in 2023 have also been provided as part of stakeholder consultation. Costs by class type were then weighted based on frequency to construct a national average cost, reported in **Table 26**. The per tonne rate of licences was then calculated to understand the increase in licences required to remove additional asbestos under options 2A and 2B. Costs to workers for training has been calculated as both the price of training, and the lost productive time, estimated on a daily wage basis.

Lastly, training costs were added to this based on training costs for mandatory occupations identified in the ACT for both the *10852NAT* and *11084NAT* courses. These are based on the cost of an accredited training course, as well as worker time taken to undergo the training. This mandatory training has been applied to all jurisdictions except for the ACT, as this training would still occur in the baseline. It is assumed that 50% of all current practicing labourers in identified occupation codes (WorkSafe ACT 2019 and 2023b) have not been trained. This increases over time in line with the roadmap, with 90% of these occupations being trained from 2030 onwards. Over the 2 years to implementation, it is assumed that existing workers will train to the 90% long-term goal, to ensure a conservative estimate of training costs. Lastly, growth in employment in these occupations has been calculated as the weighted average anticipated growth rate between plumbing and electrician VET qualifications (JSA 2021a; JSA 2021b).

Table 26. Compliance and enforcement cost assumptions

Assumption	Value	Source
Average daily income for identified occupations	$341	2021 Census (ABS), ACT WorkSafe specified occupation codes for mandatory awareness training
Asbestos Assessor – Licence cost	$824	Calculation using national licence fees, weighted by frequency
Asbestos Assessor – Training cost	$1,265	Average based on desktop review of published course costs (range $997 to $1,800)
Asbestos Assessor – Days of training	2	Based on desktop review of published course duration
Class A asbestos removalist – Licence cost	$3,654	Calculation using national licence fees, weighted by frequency
Class A asbestos removalist – Training cost	$665	Average based on desktop review of published course costs (range $420 to $950)
Class A asbestos removalist – Days of training	~1.5	Average based on desktop review of published course duration (range 1–2 days)
Class B asbestos removalist – Licence cost	$912	Calculation using national licence, weighted by frequency
Class B asbestos removalist – Training cost	$388	Average based on desktop review of published course costs (range $297 to $500)
Class B asbestos removalist – Days of training	1	Average based on desktop review of published course duration (range 1–2 days)
'Working with Asbestos' – Training costs	$388	Based on desktop review of published course cost (range $275 to $525)
'Working with Asbestos' – Days of training	0.5	Based on desktop review of published course duration
Workforce requiring mandatory 'Working with Asbestos' training	225,960	Calculation based on 2021 Census (ABS) workforce numbers for mandatory occupations identified by WorkSafe ACT
'Asbestos Awareness' – Training costs	$199	Average based on desktop review of published course costs (range $85 to $227)
'Asbestos Awareness' – Days of training	0.5	Based on desktop review of published course duration
Workforce requiring mandatory 'Asbestos awareness' training	1,107,658	Calculation based on 2021 Census workforce numbers for mandatory occupations identified by WorkSafe ACT
Compliance with existing WHS duty to provide awareness training	50%	Urbis and ASEA workshop

Assumption	Value	Source
Years to mandatory training being implemented	2	Urbis and ASEA workshop
Compliance with WHS duty to provide training under options 2A and 2B	90%	In line with Asbestos National Strategic Plan compliance goals
Key occupation growth rate	1.95%	Weighted average of Plumbing and Electrician job growth to 2026, (JSA 2021a and 2021b)

Results

Table 27 shows that the total costs of compliance and enforcement above the baseline are $503 million in Option 2A and $592 million under Option 2B. This is a smaller difference than other costs, mainly because of the upfront training costs related to making asbestos awareness training mandatory – which totals an estimated $126 million over 2 years. Most costs are borne by the industry, both with respect to awareness training and licensing. Government will see total cost increases of $54 million under Option 2A and $91.5 million under 2B. Notably, these figures do not include the wages and salaries costs of asbestos removalists or assessors as their costs are assumed to be covered within the cost of removal.

Table 27. Total additional compliance and enforcement costs, discounted 2023 dollars

Calculation	Option 1	Option 2A	Option 2B
Nominal	$0.0m	$1,342.2m	$1,685.6m
Discounted	$0.0m	$503.0m	$592.3m

5.4.5 Asbestos-related diseases

System-wide asbestos-related disease costs are expected to fall

Proactive management and removal of ACMs is expected to lead to improved health outcomes above the baseline and hence presents a cost reduction above the baseline under both options.

Assumptions

A range of assumptions and modelling practices have been adopted to consider potential ARD costs under each option. All ARD cost estimates are linked to the health model defined in Section 5.3. Cost estimates for those diseases that have been linked to asbestos exposure (i.e. mesothelioma, asbestosis, lung cancer, ovarian cancer, larynx cancer) have been obtained from the comprehensive investigation of costs by the CIE in 2018 and inflated to 2023 figures. These include costs to the health system related to hospitalisations, ongoing care and pharmaceutical treatments estimated to be delivered across all ARD cases in 2015. Costs have been inflated using consumer price index (CPI) and remain fixed in the model in 2023 financial year terms. See Appendix 4, Section 12.2.2 for calculations. This is despite health costs, on average, rising higher than inflation (ABS 2023b). To 2100, this assumption is likely to be appropriate due to the possibility of improvements to health care that will balance out any above-standard cost increases. These assumptions are shown in **Table 28**.

Table 28. Asbestos-related disease cost assumptions

Assumption	Value	Source
Delay between exposure and ARD onset	30 years	Urbis health model, see Section 5.3
Avoided costs per death avoided	$44,703 – $148,220	Derived based on costs from the CIE (2018), The economic burden of asbestos-related disease (see also Appendix 4)
Avoided management costs per incidence	$10,988 – $49,323	Derived based on costs from the CIE (2018), The economic burden of asbestos-related disease (see also Appendix 4)

Results

Cost savings are presented as negative costs in the results **Table 29** below. Savings under both options 2A and 2B arise from a reduction in ARDs, and hence reduced spending within the health system and for health services. Both options 2A and 2B see health system savings of over half a billion dollars in non-discounted terms. However, given most cost savings begin to accrue after a 30-year lag, this is reduced to an estimated $5.3 million saving under 2A and $6.8 million under 2B.

Table 29. Total additional asbestos-related disease costs, discounted 2023 dollars

Calculation	Option 1	Option 2A	Option 2B
Nominal	$0.0m	-$637.3m	-$795.0m
Discounted	$0.0m	-$5.3m	-$6.8m

5.4.6 Government incentives

Encouraging the proactive removal of asbestos

Option 2B proposes government incentives aimed at increasing the rate of safe and proactive asbestos removal. Under Option 2B, government is actively creating value in the economy via improvements to public wellbeing, economic cost savings and other non-quantified improvements. To cost these government incentives, examples of similar incentive schemes in the built form have been used. These represent a considered approach that balances government costs with outcomes delivered, noting that the final composition of any grants or incentives will be at the discretion of the Australian, state and territory governments.

Assumptions

Table 30 shows the assumptions from a range of targeted government incentives that have been modelled for the purposes of estimating costs, namely:

- **grants** to cover the full cost of removal and replacement of ACMs by homeowners, for people with a taxable income of under $45,000 per year (about 50% of the population)
- **an ACM removal tax offset** to individuals with a taxable income over $45,000 per year (about 50% of the population) for removal (only) of ACMs by homeowners.
- **interest-free loans** offered to strata corporations (about 16% of residential properties) up to the value of the cost of removal (only) of ACMs
- **tax offsets for replacement** of structures by PCBUs (in commercial properties), up to the value of the replacement cost of a similar structure. This is additional to the current tax offset available for the removal of ACMs by PCBUs
- **funding provided to cover the cost of asbestos surveys or inspections** for all residential properties, assumed to be $1,007 per inspection (ASEA 2022c).

Costs estimated relate solely to funding that will be provided by the government. Additional costs will accrue in relation to the staffing required to deliver these incentives; however, these are anticipated to be negligible given latent resources within governments to support grant or other funding.

As a proxy value for the uptake of government offering fully funded inspections, a similar long-standing public health policy was selected – the National Bowel Cancer Screening Kits. This has similarities relating to self-motivation of using the service, that it is free and made easy to Australians. In addition, it is a nationally significant and consistent program. This has yielded a 40.9% uptake and is assumed to similarly apply to the asbestos surveys and inspections being offered.

Table 30. Government incentive cost assumptions

Assumption	Value	Source
Weighted cost-coverage of ACM removal in residential properties	66.7%	Calculated based on the proportion and value of grants and tax offsets offered under the options above.
Government borrowing costs	4.8%	Parliamentary Budget Office (2023).

Assumption	Value	Source
Percentage of total residential properties managed under strata	16.0%	Australasian Strata Insights Report (Easthope et al. 2022).
Tax rate for offsets to businesses	30.0%	Upper bound of corporate tax rates – Australian Taxation Office.
Cost of residential asbestos survey	$1,007	Arranging a residential asbestos assessment, (ASEA 2022c).
Percentage of persons using a funded inspection	40.9%	In line with the percentage of people who took up use of national bowel cancer screening kits (AIHW, 2023b).

Results

Table 31 shows that the targeted government incentives in Option 2B constitute most of the total costs of removal. At approximately $1 billion dollars, the discounted cost to government for incentivising safe removal is the most substantial cost in Option 2B.

Table 31. Total additional government incentive costs, discounted 2023 dollars

Calculation	Option 1	Option 2A	Option 2B
Nominal	$0.0m	$0.0m	$3,428.9m
Discounted	$0.0m	$0.0m	$958.3m

5.4.7 Total additional costs

The total costs under options 2A and 2B above the baseline are presented in **Table 32**. Option 2A is anticipated to cost around $1.5 billion in total to 2100. Option 2B has a much higher cost profile because of both the introduction of incentives, and the bringing forward of costs because of increased removal rates. At a total estimated cost of $2.6 billion to 2100, over 40% of costs are attributed to government incentives. In nominal terms, costs in 2B are almost double that of 2A. This demonstrates the impact of bringing forward costs within the evaluation framework.

Table 32. Total additional costs, discounted 2023 dollars

Calculation	Option 1	Option 2A	Option 2B
Nominal	$0.0m	$5,392.3m	$9,535.5m
Discounted	$0.0m	$1,484.5m	$2,582.3m

5.5 Quantified Benefits

5.5.1 Health improvement

Ensuring the ongoing safe removal of asbestos

It is well accepted that only by preventing exposure to airborne asbestos fibres can the risk of developing an asbestos-related disease be prevented. This can be achieved either by the eradication of ACMs from the built environment or, if that is not reasonably practicable, preventing damage, disturbance or deterioration of ACMs. Hence the policies suggested within 2A and 2B are consistent with the duty under WHS laws to manage risks by eliminating risks or if that is not reasonably practicable, minimising risks so far as is reasonably practicable. Some of the proposals in Option 2A are important to ensure the integrity of Option 2B for example increasing the range of properties with asbestos assessment surveys, improving the competency of asbestos assessors and proactive enforcement and compliance activities; some of the proposals in Option 2A will in themselves increase the rate of removal for example requiring removal within a timeframe based on risk and extending financial reporting obligations; others are long term and may come into play during any program implemented under Option 2B for example lowering the OEL.

Health benefits to individuals of improved management and increased rate of removal of ACMs have been quantified through the estimated net difference in Disability Adjusted Life Years (DALYs) to the baseline. Due to the complex nature of discerning between occupational and non-occupational exposure, particularly in residential assets, the impact is not differentiated between these settings. Nonetheless, cost savings to businesses due to not requiring asbestos management plans has been included as a cost saving. Similarly, due to the need to have the appropriate policy and regulatory environment for the increased rate of removal, 2B is assumed to only impact the rate of removal.

Assumptions

As noted in Section 5.3, research and data available for this evaluation has not been able to estimate the predicted health impact of asbestos exposure under current policy settings. The residual risk under Option 2A and 2B has been developed collaboratively between Urbis and ASEA using modelling, and is assumed to be 9.5%, or just over half of the assumed baseline risk of 20%. Each DALY reduction is valued based on the value of a statistical life year, as per Australian Government guidelines (OIA, 2023). It is also assumed that the delay of ARD onset from an exposure is, on average, 30 years. **Table 33** shows the assumptions used.

Finally, it was noted during stakeholder consultation that there will never be a completely risk-free environment until all ACMs are removed. Furthermore, due to the long latency period between exposure and disease there is a lack of clarity around the latent risk for workers removing or carrying out asbestos-related work. As a result, the estimated risk of developing an ARD from the carrying out of removals compared to the risk of working with asbestos uncontrolled in the past is assumed to have been reduced by 99%. This is because it is assumed that removals will not exceed the OEL, noting that asbestos does not have a safe exposure level.

Table 33. Improved health outcomes assumptions

Assumption	Value	Source
Value of a Statistical Life Year	$243,117	OIA, 2023. See calculation in Appendix 3
ARD incidence risk reduction compared to the baseline	-10.5%	Urbis modelling
Delay between exposure to asbestos and ARD onset	30 years	Urbis analysis, see Section 5.3.
Risk reduction compared to historical risk	-99%	Assumption based on industry engagement and literature review

Results

Results are shown in **Table 34**. The increased rate of removal of ACMs has been isolated within the health model to understand how government incentives (under Option 2B) will benefit the health and wellbeing of Australians in addition to benefits estimated for improvements to the regulatory framework for asbestos (in both options).

Impact of changing the regulatory framework

As options 2A and 2B both propose the same regulatory and non-regulatory changes, the improved health benefit in this category is equal. This benefit is sizeable, both from a nominal and discounted perspective, capturing the present health danger that ACM poses in the built form. With a discounted health benefit of over $3 billion, there are clear positive implications of tightening the regulatory framework to better manage and more proactively remove ACMs.

Impact of increasing the rate of ACM removal

As outlined in Section 5.2.2, both options 2A and 2B increase the rate of removal. Option 2B includes government incentives which see all ACMs removed by 2068; 5 years' sooner than under Option 2A. The health model shows both options generate a health benefit from the increased removal rate; however, government incentives account for over $700 million of estimated **additional benefit** under Option 2B (see **Table 34**).

In total, the estimated health benefits from the proposals are over $4 billion once discounts are applied. It is also noted that the evaluation period ends before the full scope of net health benefits is realised due to the 30-year latency for developing an ARD.

Combined, changes to the regulatory framework and increasing the rate of ACM removal have a significant health and wellbeing impact. The health model estimates 82,012 cumulative deaths through to 2100 as a result of the asbestos legacy in the baseline. Almost 25,000 deaths are estimated to be avoided under option 2A, and 27,461 deaths avoided under option 2B. Disability adjusted life years (DALYs) consider not only the life years lost to ARDs, but the wellbeing impact of years lived with an ARD through to 2100. In the baseline, it is estimated that the asbestos legacy sees 1,266,652 DALYs lost across Australia to ARDs through to 2100. Option 2A is estimated to reduce the DALY burden by 470,446 and option 2B by 517,924. These DALY estimates drive the economic benefit calculated for health improvement, with each avoided DALY equivalent to the value of a statistical life year.

Table 34. Total additional health outcome benefits, discounted 2023 dollars

Calculation	Option 1	Option 2A	Option 2B
Benefit from regulatory improvements – nominal	$0.0m	$79,252.9m	$79,252.9m
Benefit from regulatory improvements – discounted	$0.0m	$3,173.2m	$3,173.2m
Benefit from increased removal rate – nominal	$0.0m	$35,120.5m	$46,663.3m
Benefit from increased removal rate – discounted	$0.0m	$1,034.1m	$1,581.5m
Total health benefit – nominal	**$0.0m**	**$114,373.4m**	**$125,916.2m**
Total health benefit – discounted	**$0.0m**	**$4,207.3m**	**$4,754.7m**

5.5.2 Mitigated disaster costs

There is a latent risk of ACM remaining in the built form due to extreme weather and other disaster events (e.g. seismic, industrial, terrorist etc.). The literature review presents prominent cases of where otherwise avoidable asbestos exposure risks are created because of fire, flood or other climate events. Stakeholder consultation reinforced that climate change is now one of the key dangers relating to the risk of exposure to asbestos fibres through the evaluation period.

To quantify the impact of climate change, a model based on assets at risk has been developed. This draws a link between the known risks of climate change to built form assets at a national level and is consistent with leading asset risk investigations in Australia (Mallon et al. 2019; Hutley et al. 2022). An annual risk-weighted assessment, based on 2030 risk reporting for high and medium risk categories, has been applied to the anticipated flow of ACM in each year (Hutley et al. 2022). This means that it is assumed that some proportion of ACM may leave the built form due to a disaster event in any given year, as opposed to estimating when and where a disaster event may occur. Hence, the value ‘smooths out’ the ACMs leaving the built form because of disasters. By removing ACM proactively, the cost of asbestos-contaminated waste cleanup can be mitigated. As outlined in the literature review, this is because disasters increase the amount asbestos waste compared to planned removal, making it more costly to dispose.

Disaster events are also known to be significant acute exposure events, as demonstrated within the literature review. The risk of exposure to asbestos fibres is captured using this risk-weighted approach.

Assumptions

It is assumed that ACM containing assets are at the same risk of disasters as all other assets across Australia. This is likely to be a conservative assumption given there are significant stocks of ACMs that remain in rural and remote areas, where climate change risk is heightened. It is also assumed that the health impact of asbestos exposure due to a disaster event is high because it is an uncontrolled exposure due to lack of protection from exposure akin to historical exposures. It is noted that while these events do not cause repeated cumulative exposure, the acute nature of exposure presents a future health risk (Kim et al. 2020).

Lastly, costs have been constructed through data provided during stakeholder consultation by NSW Emergency Management and further client listening, which estimates costs as incrementally higher that standard disposal. Assumptions are shown in **Table 35. Mitigated disaster cost assumptions**As demonstrated in Section 5.2.2, the average ACM tonnage of homes in the Latrobe Valley was estimated to be 0.52 tonnes per property, while estimates from the Black Summer Bushfires and North Coast Floods were 158 and 7.7 tonnes of asbestos-contaminated waste per property respectively. With such a large increase in volume of asbestos-containing waste, it is assumed that the cost premium of the unexpected removal is less than individual properties due to economies of scale, but still higher than regular removal.

Table 35. Mitigated disaster cost assumptions

Assumption	Value	Source
Asbestos exposure risk	100%	Assumption – exposure during a disaster event is akin to historical exposures.
Cost premium for ACM waste resulting from disaster events	12%	Estimated based on primary data and market sounding from NSW Emergency Management.

Assumption	Value	Source
Cost of waste management per tonne	$495	Urbis calculation based on cost premium and weighted average waste disposal cost, see Section 5.4.3.
Delay between exposure to asbestos and ARD onset	30 years	Urbis analysis, see Section 5.3.
Assets at high and medium risk due to climate change	13% (national average)	Hutley et al. (2022). Broken down by state for assets at high risk.
Value of a Statistical Life Year	$243,117	OIA, 2023. See calculation in Appendix 3.

Results

Results are shown in **Table 36**. The benefits of disaster cost mitigation are estimated to be of higher value in relation to avoided health impacts. As a result, nominal benefits are significantly larger than discounted benefits. Overall, the total benefit related to disaster mitigation costs are $58.8 million under Option 2A and $99.4 million under Option 2B.

Table 36. Total additional mitigated disaster benefits, discounted 2023 dollars

Calculation	Option 1	Option 2A	Option 2B
Nominal	$0.0m	$2,044.2m	$3,301.6m
Discounted	$0.0m	$58.8m	$99.4m

5.5.3 Other avoided costs

Avoided costs are anticipated to provide long-term savings across jurisdictions, as outlined in the literature review. Across the quantified costs included within the CBA, a series of avoided costs are anticipated to be observed above the baseline under options 2A and 2B. The **avoided costs** quantified for the analysis are:

- costs due to a reduction in unexpected removal situations. This is because of improved assessor competence and regulatory changes to unlicensed removals
- illegal asbestos disposal costs
- training, licensing and government staffing costs following complete ACM removal in Australia
- cost of asbestos management to businesses.

These avoided costs are benefits to the economy, as they represent a reduction in the regulatory and resource burden of the ongoing management of asbestos in Australia.

Assumptions

The reduction in unexpected removal costs is the difference between the number of ACMs removed in the baseline with unexpected cost, and those under options 2A and 2B. Following the completion of removal activity, the tail of ACM that would be removed with unexpected conditions under Option 1 is also calculated, as this will no longer be experienced under 2A and 2B. With ACMs removed from the built form at an increased rate, PCBUs will no longer be required to maintain asbestos management plans. The extent to which this is PCBUs will no longer require management plans above the base case due to increased removal is estimated.

Avoided illegal asbestos disposal costs are calculated as the percentage of waste that is additionally removed under option 2A and 2B that would otherwise be expected to be illegally disposed. This uses benchmarks established in prior work from ACIL Allen Consulting (2016) which establishes that approximately 5% of asbestos-containing waste is illegally disposed, with costs inflated to FY2023 terms. The additional cost per tonne of illegally dumped waste is calculated as the total estimated per-tonne cost of $2,224 (ACIL Allen Consulting 2016) less the weighted average cost of waste management per tonne of $312). This cost saving therefore assumes that under options 2A and 2B, increased removal activities and the associated compliance activities mean that any additionally removed ACM is not illegally disposed.

Upon ACM no longer being in the built form, there will no longer be a need for a trained workforce and government compliance staff compared to the baseline. The cost saving of licence and training costs, as well as government compliance staff costs, has therefore been estimated from the estimated time that asbestos has been completely removed from Australia's buildings. Avoided cost assumptions are summarised in **Table 37**.

Table 37. Other avoided cost assumptions

Assumption	Value	Source
Cost saving per tonne of ACM removed at expected, instead of unexpected, cost	$2,174	Calculated based on costs in Section 5.4.1
Cost saving per tonne of illegally disposed ACM	$1,912	ASEA, ACIL Allen Consulting (2016)
Average cost of asbestos management per year	$414,106	Victorian average cost for a medium to large business with asbestos compliance obligations, Deloitte (2017), inflated using CPI to 2023 dollars
Real avoided compliance staff costs the first year following complete removal – 2A	$13.5 million	Urbis modelling based on FTE staff no longer required. Method contained in Section 5.4.4.
Real avoided compliance staff costs the first year following complete removal – 2B	$15.2 million	Urbis modelling based on FTE staff no longer required. Method contained in Section 5.4.4.

Results

Results are shown in **Table 38**. Avoided costs are a substantial benefit under both options 2A and 2B. The ongoing benefits of reduced asbestos management plan costs alongside the reduction in unexpected removal costs are considerable while removal activity is ongoing.

At its peak in 2036, avoided unexpected costs will see a saving of over $12.6 million per annum to the Australian economy, while avoided costs of asbestos management total over $10 million by 2076.

Illegally disposed ACM cost savings average $1.3 million per year through the evaluation period.

Lastly, the avoided costs of training, licensing and government compliance staff once ACM removal is completed (i.e. 2073 or 2068) is estimated to be worth over $13 million per annum in both options 2A and 2B. This is a significant freeing of resources and skills across the economy and drives long-term cost-saving benefits in the model.

Table 38. Total additional benefits from other avoided costs, discounted 2023 dollars

Option	Option 1	Option 2A	Option 2B
Nominal	$0.0m	$1,146.3m	$1,220.2m
Discounted	$0.0m	$232.4m	$240.1m

5.6 Qualitative Impacts

5.6.1 Costs

Government services costs and opportunity cost reductions

This trade-off reflects the opportunity cost of directing government resources to other areas and is captured in the discount rate; however, there may be distinct pulls on resources that may be above the typical 7% per annum discount rate. Examples of cost increases may be those related to the disbursement of incentives, any additional workforce capacity not related to the compliance and enforcement costs captured above, or any roles or responsibilities that are needed to be created to coordinate the implementation of options 2A and 2B.

Given the above, changes to government services costs are expected to have a low economic impact in both 2A and 2B.

5.6.2 Benefits

Insurance premiums on property

Insurance payouts to workers and landowners related to asbestos are transfers as opposed to economic costs or benefits (Commonwealth of Australia, 2006). However, the presence of asbestos in the built form necessitates a specific insurance premium to asset owners and operators, the cost of which is faced by residences and businesses. A primary investigation of current asbestos liability insurance premiums found that the upper bound quote to small-medium businesses is $6,000 per annum. Proactive removal of ACMs from the built environment will mean this premium will not be required to be taken out by asset owners and hence a cost saving will be delivered.

Given the above, changes to insurance premiums are expected to have a low economic impact in both option 2A and 2B.

Reduction in legal dispute costs and payouts

Legal dispute payouts are not an economic benefit, but rather a transfer from one party to another. Nonetheless, fees and court resources used for asbestos-related matters are a resource burden in the economy resulting from the historic and present-day presence of asbestos. Hence, by removing ACMs proactively, the eventual reduction in future legal dispute costs, both in the form of legal fees to individuals and/or businesses and the court system, will be a benefit.

Given the above, reduction in legal dispute costs and payouts is expected to have low economic impact under options 2A and 2B.

Improved productivity from a healthier population

The quantified costs and benefits presented in this evaluation look to the system-wide cost impacts of asbestos, as well as individual health burden experience by those with ARD. Beyond this, there is a significant loss of both paid and unpaid productive labour that arises when people develop ARDs. The nature of exposure is changing in Australia, with a higher proportion anticipated to be exposed in non-occupational settings into the future (Mahoney et al. 2023). This shift creates uncertainty related to how productivity will be impacted, as a more diverse group of workers, and people of a younger age profile, are impacted to a greater extent (Mahoney et al. 2023). This will be a significant additional cost to the economy above the disability adjusted life year impact estimated within the model; however, due to the uncertain nature of exposure type, it has not been included in the present study.

In a report prepared for ASEA, the productivity loss due to ARDs was calculated by the CIE (2018). The CIE found that asbestos exposure has historically been a result of workplace exposure, with certain professions identified as at risk (CIE 2018). By aligning the occupations that were at risk of exposure, alongside anticipated non-occupation exposure rates in 2015, an Australia-wide estimate of productivity loss was estimated. In 2015 alone, it was predicted that between $225.3 and $451.2 million was lost in productivity because of ARDs (CIE 2018, pp. 55). As exposure–risk patterns change over time, it is unclear whether the productivity cost profile will increase or decrease. Observations that exposure is occurring at earlier ages in the non-occupational setting indicates that these costs may be rising on a per-ARD basis, as workers may be forced to leave the workforce at an earlier stage of life.

Given the above, improved productivity is expected to have a high economic impact. This is likely to be higher in options 2B than 2A because of increased removal rates.

Improved productivity and increased development activity from less red tape

Staging, holding costs and escalation have significant impacts on the costs to and productivity of developers. As ACMs leave the built form, there will be reduced requirement relating to the identification and testing of ACMs in structures and soils. This has enhancements to the flexibility of land use, and the cost-effectiveness of new development. There are significant anticipated benefits relating to streamlined development processes. Further investigation into the extent of delays to projects caused by unexpected ACMs finds will allow the true cost saving and productivity benefit of this element to be understood. At present day, however, there is not sufficient data to understand the number of impacted assets, nor the jurisdiction-specific delays caused by standard assessment processes.

Given the above, improved productivity of development activity is anticipated to have a moderate economic impact. This is likely to be higher under Option 2B.

Comfort and peace of mind from national removal

As noted in the literature review, psychological disorders can also develop because of a diagnosis of an ARD. Further to this, people exposed to asbestos can suffer from significant psychological distress even with no disease (ASEA 2021a: 10). This has significant productivity, health cost and wellbeing implications which have not been captured within the quantified health burden.

Recent global research into psychological distress demonstrates that it poses vast impacts to workforce participation and wellbeing. Müller et al. (2021) quantified the impact of self-reported distress on worker participation and health costs over a two-year period and 2,287 workers in Germany. They found that those identified as having high levels of distress had over 20 times the number of days where they were incapable of working and spent over 11 times more on medical treatment. Furthermore, even among those that did not miss work, 42% reported presenteeism, where one attends work despite psychological distress. Unresolved psychological distress from the presence and exposure to ACMs thus represents a clear detriment in the baseline.

Beyond psychological distress, there is also a peace of mind benefit anticipated across the public because of the asbestos legacy being resolved. It was reported by a stakeholder from Healthy Homes Victoria that there are significant physical and non-physical health benefits to people who may suspect or know they are living in houses with hazardous materials present including peace of mind. At present there has been no identified economic quantification of the value of peace of mind.

Given the above, comfort and peace of mind benefits are anticipated to have a moderate economic impact. This is likely to be higher under Option 2B as there is government support for those who may be concerned about the presence of ACMs, but otherwise incapable to deal with it due to financial constraints.

Corporate reputation

As noted in the literature review (Chapter 2), owners and operators of businesses are increasingly being required to demonstrate a positive obligation to act in the best interests of the environment and society, which means governing their operations to the highest possible standard. This has recently formalised through the formalisation of ESG considerations in both financial and governance disclosures.

As noted by McGregor et al. (2021: 307), liabilities related to asbestos are likely to meet the materiality criterion for disclosure in financial statements and should be addressed there, even if separately addressed in sustainability or annual reports. Currently there is no obligation to do so, and nor are owners and operators acting proactively to do so. Hence, proper disclosure of asbestos-related liabilities is needed to ensure financial statements are an accurate reflection of the entity's financial position (McGregor et al. 2021: 316). Some global standards already apply to asbestos disclosures in relation to workplaces; however, extending this obligation to residential assets should be considered. For example, in early 2023 the Australian Government launched an industry developed ESG reporting standard for community housing as part of a broader housing initiatives (Collins 2023) which could cover ACM. The benefit of better managing asbestos is likely to then flow through to corporate reputational improvement.

Conversely, a positive obligation for commercial operators to disclose asbestos liabilities, such as proposed in Option 2A, will see those owners unwilling or unable to disclose face investor push-back and potentially fines or other enforcement measures. Hence, this benefit will either be realised through rewarding best practice or punishing poor performance.

Given the above, corporate reputation improvements are anticipated to have a low economic impact above those already considered under options 2A and 2B.

Environmental benefits

Environmental impacts of asbestos include contamination of soil, water and air. As noted in the literature review, the better management of asbestos in Australia is likely to reduce the level of land contamination caused by poor and illegal practices, which will in turn reduce the amount of unusable land.

A second environmental benefit of proactive management of asbestos is the ability to prevent stored carbon leaving the built form unnecessarily. The embodied carbon of a new 2-bedroom house in the UK has been estimated to total 80 tonnes of CO_2 equivalent embodied carbon (Ashworth, 2022). Recent research by AECOM on the difference between deeply renovated and knockdown-rebuild housing found that a renovation can save up to half of all embedded carbon costs (Cheshire and Burton, 2023). This is a potential net difference of up to 40 tonnes of CO_2 equivalent saved in the built form, where a conversion of a standalone home is achieved as opposed to a knockdown-rebuild. Using recent NSW Carbon value guidance (TPG23-08, NSW Treasury 2023), this is worth an estimated $5,000 in carbon abatement. This carbon value reduction would be observed where asbestos contamination makes a knockdown-rebuild the only safe option, or where a lack of ACMs in an asset makes a conversion or renovation the more attractive option from a cost and/or time perspective. This benefit will become more valuable over time, as carbon in the built form constitutes upwards of 40% of all carbon and asset owners will need to reduce carbon impact over time to meet ESG and government mandated carbon expectations.

Given the above, environmental benefits are anticipated to have a high economic impact. This will be higher under Option 2B.

Asset value

As noted in the literature review, Warren-Myers and Cradduck (2021) found that Australian property valuers identified asbestos presence as a physical risk to properties in valuation practice, although did not indicate a range of prices. Furthermore, international evidence has determined that asbestos presence in the US impacted house values by up 13.44%. Evidently, there are price implications to property that arise from the presence of asbestos in the built form. However, determining the materiality of economic benefit in asset value differences is multifaceted. Additional consultation with Australian valuers, and economic evaluation best-practice guidance has determined that there are significant limitations in aligning asset value differences with economic costs or benefits.

Price signals relating to assets do not constitute an economic benefit or cost in and of themselves. To substantiate economic impact, a willingness to pay methodology can be implemented which considers catchments of assets and their proportional price differences to those in adjacent catchments. As the exact location of ACMs in the built form is not well-known, there are data limitations to undertaking this kind of analysis within the present study. Furthermore, due to the historic nature of ACM use, there will be significant co-contributors to any differences in asset value, including asset age, location and general amenity.

A second limitation in attributing a quantified economic impact to asset values due to asbestos presence is that there is ambiguity around if prices are a transfer or a reflection of value. Similarly, there was little evidence from both stakeholder consultation and the literature review that the removal of ACM improves the value of the asset above the cost of removal.

Recent examples of programs aimed at improving asset safety and value is the loose-fill remediation and removal program that recently concluded in the ACT. As reflected in the literature review, there were two key drivers of difference in the anticipated and actual cost of the program – removal costs were lower, and land values were higher at resale than anticipated. Isolating the resale value of the land as an economic benefit was not undertaken within the program evaluation, and as the fixed assets were not factored into the purchase or resale value, evidence of built form value improvements from this program are ambiguous.

While there is not sufficient evidence to include asset value as part of the quantified benefits, there is a significant body of evidence that indicates price improvements to asset owners and occupants because of proactive ACM removal. Furthermore, land value may also be improved through proactive ACM removal in the form of avoided loss of use due to contaminated land, and cost savings of avoided remediation on a site. Finally, removal of ACMs will help in future-proofing the resilience and safety of assets, particularly in areas prone to extreme weather and disaster events.

Given the above, the impacts relating to asset value are expected to have a moderate economic impact. This asset value impact is likely to be greater under Option 2B.

5.7 Results

The overall results of the analysis are displayed in **Table 39**.

Table 39. Economic evaluation of asbestos removal options, discounted 2023 dollars

Item	Option 1	Option 2A	Option 2B
Discounted costs			
Removal costs	$0.0m	$778.0m	$688.7m
Loss of asset use	$0.0m	$177.9m	$297.7m
Waste management	$0.0m	$30.9m	$52.2m
Compliance and enforcement	$0.0m	$503.0m	$592.3m
Asbestos-related disease costs	$0.0m	-$5.3m	-$6.8m
Government incentives	$0.0m	$0.0m	$958.3m
Total costs	**$0.0m**	**$1,484.5m**	**$2,582.3m**
Discounted benefits			
Health improvement	$0.0m	$4,207.3m	$4,754.7m
Mitigated disaster costs	$0.0m	$58.8m	$99.4m
Other avoided costs	$0.0m	$232.4m	$240.1m
Total benefits	**$0.0m**	**$4,498.5m**	**$5,094.2m**
Net present value	**$0.0m**	**$3,014.0m**	**$2,511.8m**
Benefit cost ratio	**1.00**	**3.03**	**1.97**

An overview of the qualitative costs and benefits identified in the analysis are displayed in **Table 40**.

Table 40. Overview of qualitative costs and benefits

Item	Impact – 2A	Impact – 2B
Qualitative costs		
Government services costs and opportunity cost reductions	Low impact	Low impact
Qualitative benefits		
Insurance premiums on property	Low impact	Low impact
Reduction in legal dispute costs and payouts	Low impact	Low impact
Improved productivity from a healthier population	High impact	Higher impact
Improved productivity and increased development activity	Moderate impact	High impact
Comfort and peace of mind from national removal	Moderate impact	High impact
Corporate reputation	Low impact	Low impact
Environmental benefits	High impact	Higher impact
Asset value	Moderate impact	High impact

5.8 Sensitivity Analysis

Sensitivity analysis is done to ensure the robustness of an economic evaluation against key inputs and assumptions. This allows for an assessment of the level to which the true value of implementing options 2A and 2B may change under different scenarios. A range of sensitivity tests were undertaken to understand the impact of the highest impact variables in the model. These include:

- the discount rate
- assumed ACM removal rates (+-20%)
- ARD onset (+-5 years)
- removal costs (+-20%).

Key insights are provided below the reported outcomes (i.e. changes in NPV and BCR) of the sensitivity analysis.

5.8.1 Discount rate

Table 41 and **Table 42** show the effect of varying the discount rate only. This impacts the value of future costs and benefits, with a higher discount rate making future costs and benefits less valuable in today's terms.

Table 41. Sensitivity testing of the discount rate on the NPV of each option $millions

	NPV – Effect of discount rate		
	3% discount rate	7% discount rate	10% discount rate
Option 1	$0.0m	$0.0m	$0.0m
Option 2A	$23,045.6m	$3,014.0m	$408.2m
Option 2B	$24,102.9m	$2,511.8m	-$113.5m

Table 42. Sensitivity testing of the discount rate on the BCR of each option

	BCR – Effect of discount rate		
	3% discount rate	7% discount rate	10% discount rate
Option 1	1.0	1.0	1.0
Option 2A	9.0	3.0	1.4
Option 2B	5.7	2.0	0.9

Key insights

- Due to the long lag between policy impact and benefit realisation, the CBA is sensitive to discount rates.
- A 3% discount rate is better aligned with the social nature of the policy question, and at a BCR of over 5 for both options, this is a strong indication of long-term value being created as a result of the proposals in both options 2A and 2B.
- Discount rates have a greater impact on Option 2A; however, the BCR it is still positive using a 10% discount rate.

5.8.2 ACM removal rates

Table 43 to **Table 46** estimate the impact of a 20% increase and 20% decrease in the rate of ACM removal, and how this interacts with different discount rates.

Table 43. Sensitivity test of a 20% increase to ACM removal rates on the NPV of each option, $million

	NPV – Increased ACM removal rate		
	3% discount rate	7% discount rate	10% discount rate
Option 1	$0.0m	$0.0m	$0.0m
Option 2A	$24,193.6m	$3,034.1m	$337.5m
Option 2B	$23,712.7m	$2,065.6m	-$477.9m

Table 44. Sensitivity test of a 20% increase to ACM removal rates on the BCR of each option

	BCR – Increased ACM removal rate		
	3% discount rate	7% discount rate	10% discount rate
Option 1	1.0	1.0	1.0
Option 2A	8.2	2.8	1.3
Option 2B	4.6	1.6	0.8

Table 45. Sensitivity test of a 20% decrease to ACM removal rates on the NPV of each option, $million

	NPV – Decreased ACM removal rate		
	3% discount rate	7% discount rate	10% discount rate
Option 1	$0.0m	$0.0m	$0.0m
Option 2A	$21,935.3m	$2,998.1m	$479.0m
Option 2B	$23,396.5m	$2,712.7m	$137.0m

Table 46. Sensitivity test of a 20% decrease to ACM removal rates on the BCR of each option

	BCR – Decreased ACM removal rate		
	3% discount rate	7% discount rate	10% discount rate
Option 1	1.0	1.0	1.0
Option 2A	10.1	3.4	1.5
Option 2B	7.0	2.4	1.1

Key insights

- As costs are experienced much earlier than benefits, increased rates of ACM removal have a negative impact on the NPV and BCR. This indicates that even without an increase in removal rates, there are benefits to the improved safety and regulation proposed under Option 2A.
- In nominal terms, increased ACM removal rates are a net positive, although as demonstrated, any discount rate above 0% sees acceleration costing more in real terms than benefits accrued.

5.8.3 Cost of removal

Table 47 to **Table 50** estimate the impact of a 20% increase and 20% decrease in the cost of removal, and how this interacts with different discount rates.

Table 47. Sensitivity test of a 20% increase to the cost of removal on the NPV of each option, $million

	NPV – Increased cost of ACM removal		
	3% discount rate	7% discount rate	10% discount rate
Option 1	$0.0m	$0.0m	$0.0m
Option 2A	$22,759.1m	$2,885.8m	$329.1m
Option 2B	$23,475.7m	$2,218.5m	-$297.8m

Table 48. Sensitivity test of a 20% increase to the cost of removal on the BCR of each option

	BCR – Increased cost of ACM removal		
	3% discount rate	7% discount rate	10% discount rate
Option 1	1.0	1.0	1.0
Option 2A	8.0	2.8	1.3
Option 2B	5.0	1.8	0.8

Table 49. Sensitivity test of a 20% decrease to the cost of removal on the NPV of each option, $million

	NPV – Decreased cost of ACM removal		
	3% discount rate	7% discount rate	10% discount rate
Option 1	$0.0m	$0.0m	$0.0m
Option 2A	$23,332.1m	$3,142.2m	$487.3m
Option 2B	$24,729.5m	$2,804.5m	$70.4m

Table 50. Sensitivity test of a 20% decrease to the cost of removal on the BCR of each option

	BCR – Decreased cost of ACM removal		
	3% discount rate	7% discount rate	10% discount rate
Option 1	1.0	1.0	1.0
Option 2A	10.2	3.4	1.5
Option 2B	6.6	2.2	1.0

Key insights

The economic impact of changes to the ACM removal cost is not significant, with NPV and BCR results across options and discount rates robust to both increased and decreased costs.

- Increased costs of ACM removal have a negative impact on the NPV and BCR.
- At a 7% and 3% discount rate, increased costs still see an estimated net positive result. As these are more indicative of the social nature of the evaluation, this means the central case will be robust to above-inflation cost impacts of increased removal rates.

5.8.4 ARD onset delay

Table 51 to **Table 54** estimate the impact of a 5-year decrease (earlier) and 5-year increase (delay) in onset of ARDs from the time of exposure, and how this interacts with discount rates.

Table 51. Sensitivity test of a 5-year decrease to the onset of ARDs from the time of exposure on the NPV of each option, $million

	NPV – Earlier ARD onset		
	3% discount rate	7% discount rate	10% discount rate
Option 1	$0.0m	$0.0m	$0.0m
Option 2A	$25,354.2m	$3,638.4m	$649.2m
Option 2B	$26,727.8m	$3,359.7m	$232.7m

Table 52. Sensitivity test of a 5-year decrease to the onset of ARDs from the time of exposure on the BCR of each option

	BCR – Earlier ARD onset		
	3% discount rate	7% discount rate	10% discount rate
Option 1	1.0	1.0	1.0
Option 2A	9.8	3.5	1.6
Option 2B	6.2	2.3	1.1

Table 53. Sensitivity test of a 5-year increase to the onset of ARDs from the time of exposure on the NPV of each option, $million

	NPV – Delayed ARD onset		
	3% discount rate	7% discount rate	10% discount rate
Option 1	$0.0m	$0.0m	$0.0m
Option 2A	$20,855.2m	$2,545.3m	$249.9m
Option 2B	$21,653.2m	$1,883.5m	-$337.2m

Table 54. Sensitivity test of a 5-year increase to the onset of ARDs from the time of exposure on the BCR of each option

	BCR – Delayed ARD onset		
	3% discount rate	7% discount rate	10% discount rate
Option 1	1.0	1.0	1.0
Option 2A	8.2	2.7	1.2
Option 2B	5.2	1.7	0.8

Key insights

- The timing of ARD onset following exposure changes the benefit profile significantly, adding or subtracting approximately $350 million in benefit for each 5-year period under Option 2A.
- The BCR is robust to changes in the assumed ARD onset delay following asbestos exposure.
- Lowering the delay between exposure and ARD onset means that individuals have symptoms earlier, or at a younger age, and hence the benefit of avoiding ARD is greater.

6. Conclusion

The socio-economic evaluation set out to determine the extent of net benefits to Australians if policy shifts from in situ ACM management to more proactive management and removal, consistent with the hierarchy of control used in WHS laws.

Importantly, there is a significant reduction in the number of ARD related deaths from an increased rate of ACM removal, stemming the tide of avoidable fatalities from asbestos exposure:

- Option 2A could see all in-scope ACMs removed by 2073, preventing up to 24,973 deaths from ARDs during the evaluation period
- Option 2B could see all-in scope ACMs removed as early as 2068, preventing approximately 27,461 deaths from ARDs during the evaluation period.

In today's money calculated up to 2100, this creates health savings of $4.2 billion under Option 2A, and $4.8 billion under Option 2B, accounting for over 93% of all the benefits generated. This shows that while removal timeframes resulting from the options appear modest at 50 and 45 years (from 2023) respectively, the impact on human health in terms of lives saved and costs reduced is substantial. Under Option 2B, Australian families will avoid losing over 27,000 loved ones from an ARD; around 10% fewer than under Option 2A.

The NPV of the options, derived from costs and benefits discounted to 2023 dollars, is:

- $3.014 billion for Option 2A
- $2.512 billion for Option 2B.

The BCR was calculated for both options, showing implementing:

- Option 2A is estimated to return $3.03 to the economy for every dollar expended.
- Option 2B is estimated to return $1.97 to the economy for every dollar expended, as incentives add to the overall costs.

Sensitivity analysis shows the results are robust to changes in the discount rate, key costs, and key benefit assumptions.

Both options have additional benefits which could not be quantified as part of the analysis. These relate to anticipated asset value improvements that may result from proactively removing ACMs from property, which are expected to produce both productivity and value outcomes. There are also expected to be significant environmental benefits arising from the options, including avoided carbon emissions and potentially less contaminated land issues.

The impact of the qualitative benefits is all the same or higher under Option 2B. This shows government initiatives significantly augment value creation beyond what was quantified in the NPV and BCR.

In summary, this socio-economic evaluation demonstrates a clear benefit arising from a suite of regulatory and policy framework adjustments in Australia to promote the proactive removal of ACM. Improving the regulatory framework for asbestos offers the greatest net benefit to the economy, but government incentives combined with regulatory improvements will result in faster reduction of ACMs and substantially fewer deaths from ARDs and higher qualitative benefits.

For decision-makers, this socio-economic evaluation provides a comprehensive and compelling evidence base for considering actions in the next ANSP that will advance efforts to eliminate ARDs in Australia.

7. Disclaimer

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Appendix 1

Licence Fees

Table 55. SafeWork New South Wales Licence Fees 2022/2023

The fee schedule displays the fees for authorisations administered by SafeWork NSW.

Licence/Certificate/Registration/ Notification type	Duration (years)	New	Renew	Amend	Replace
Asbestos Assessor	5	$599	$599	N/A	$37
Asbestos Removal – Class A	5	$6,129	$6,129	N/A	$37
Asbestos Removal – Class B	5	$1,112	$614	N/A	$37

Source: SafeWork NSW (2023a).

Table 56. WorkSafe Victoria Licence Fees 2022/2023

Licence/Certificate/Registration/ Notification type	Duration (years)	New	Renew	Replace
Asbestos Assessor	N/A	N/A	N/A	N/A
Asbestos Removal – Class A	5	$1,157.45	$1,157.45	$45
Asbestos Removal – Class B	5	$986.20	$986.20	$45

Source: WorkSafe Victoria (2022).

Table 57. WorkSafe Queensland Licence Fees 2022/2023

ABLIS business.gov.au Asbestos removal licence – A and B class - Queensland

Licence/Certificate/Registration/ Notification type	Duration (years)	New	Renew	Replace
Asbestos Assessor	5	$202.64	$202.64	$40.64
Asbestos Removal – Class A	5	$202.64	$202.64	$40.64
Asbestos Removal – Class B	5	$202.64	$202.64	$40.64

Source: WorkSafe Qld (2022)

Table 58. SafeWork South Australia Asbestos Licence Fees 2022/2023

Licence/Certificate/Registration/ Notification type	Duration (years)	New	Renew	Replace
Asbestos Assessor	5	$2,289	N/A	$128
Asbestos Removal – Class A	5	$26,780	N/A	$128
Asbestos Removal – Class B	5	$4,080	N/A	$128

Source: SafeWork SA (2020).

Table 59. WorkSafe Western Australia Asbestos Licence Fees – from 31 March 2022

Licence/Certificate/Registration/ Notification type	Duration (years)	New	Renew	Amend	Replace
Asbestos Assessor	N/A	$7,490	$7,417	N/A	$35.00
Asbestos Removal – Class A	N/A	$5,716	$4,384	$5,245	$33.00
Asbestos Removal – Class B	N/A	$1,287	$1,191	$5,245	$33.00

Note: Renewal of interstate licences same cost as a new licence. Source: DMIRS (2022).

Table 60. WorkSafe Australian Capital Territory Licence Fees 2022/2023

Licence/Certificate/Registration/ Notification type	Duration (years)	New	Renew	Amend	Replace
Asbestos Assessor	N/A	$507	N/A	N/A	$49.00
Asbestos Removal – Class A	5	$2,118	N/A	N/A	$49.00
Asbestos Removal – Class B	5	$1,971	N/A	N/A	$49.00

Source: ACT Government (2022c)

Table 61. WorkSafe Tasmania Asbestos Licence Fees from 1 July 2022

Licence/Certificate/Registration/ Notification type	Duration (years)	New	Renew	Replace
Asbestos Assessor	5	$85	$51	$17
Asbestos Removal – Class A	5	$1,334.50	$912.90	$17
Asbestos Removal – Class B	5	$982.60	$561	$17

Source: Service Tasmania (2022).

Table 62. Northern Territory WorkSafe Asbestos Licence Fees from 1 July 2022

Licence/Certificate/Registration/ Notification type	Duration (years)	New	Renew	Replace
Asbestos Assessor	5	$269	$114	$43
Asbestos Removal	5	$3,276	$3,276	$43

Note: Split between Class A and Class B not provided. Source: NT WorkSafe (2022).

Appendix 2

Licensed asbestos removalists and assessors as at June 2023

Table 63. Licensed asbestos removalists and assessors (June 2023)

Jurisdiction	Class A	Business or individuals	Class B	Business or individuals	Assessors	Business or individuals
Qld	159	Business	1,350	Business	170	Individuals
SA	16	Business	73	Business	79	Individuals
Vic.	72	Business	548	Business	0	Not licensed
Tas.	15	Business	50	Business	49	Individuals
NSW	133	Both	1,233	Both	651	Both
ACT	28	Business	30	Both – 21 Businesses / 9 Individuals	107	Individuals
WA	18	Business	708	Both	37	Individuals
NT	8	Business	22	Business	68	Individuals (31 Interstate)
Commonwealth	N/A	Business	N/A	Business	0	Not licensed
Total	449		4,014		1,161	

Sources: WorkSafe QLD (2023); SafeWork SA (2023); WorkSafe Vic. (2023), WorkSafe Tas. (2023); SafeWork NSW (2023b); WorkSafe ACT (2023a); DMIRS WA (2023); WorkSafe NT (2023); Comcare, personal communication).

Appendix 3

Organisations participating in stakeholder consultation

Target organisations were identified by ASEA based on its knowledge of the expertise that organisation could offer on the data and information gaps and supplemented with additional contacts suggested by Urbis.

In summary, the organisations or contacts are a mix of:

- Australian Government departments/agencies
- state government departments/agencies
- local governments
- industry organisations and businesses
- technical experts
- academics.

Outreach to target organisations identified for interview was undertaken by ASEA with an initial email and followed up by Urbis on multiple dates.

ASEA made initial contact via email requesting assistance. The email subject was '**Invitation: Input into evaluation of national asbestos management and removal options'.**

Email content to target organisations

> The Asbestos National Strategic Plan provides a long-term phased approach to eliminate asbestos-related diseases in Australia. Phase one of the plan covered 2014–2018, and we are now in phase 2, which will end in 2023. The next phase will consider how to remove asbestos containing materials (ACMs) from the environment in a sustainable and safe way. The socio-economic evaluation will help us determine the actions to be included in the next phase to achieve this objective.
>
> As part of developing the methodology for the evaluation, an extensive literature review was undertaken which identified information gaps on the:
>
> 1. Risk profile of asbestos-containing materials
> 2. Impact of asbestos on property values
> 3. Capacity and costs of asbestos landfill
> 4. Workforce capacity, industry oversight and regulation, and
> 5. Environment.
>
> Your input as a respected expert with applied knowledge in these areas is requested to ensure a balanced and rigorous evaluation. Your knowledge will particularly assist us to better understand the [area of expertise from the list above].
>
> Urbis Pty Ltd (Urbis) have been engaged to do the evaluation. We would greatly appreciate your participation in a 30-minute virtual meeting with an Urbis representative, Kylie Newcombe. Meetings are being scheduled over the next 2 weeks using doodle: https://doodle.com/meeting/participate/id/dNYRGDKb
>
> Please use the link to indicate at least 2 preferred time slots. Scroll across to view meeting options on later days. Once your selection is made, Kylie will send through an outlook appointment with a Microsoft Teams meeting link.
>
> You can also request further information on the project by contacting Natarsha Furiosi on (02) 6121 9396 or Plan.Reporting@asbestossafety.gov.au.
>
> Thank you for your assistance with this important work.

Meetings with those who responded were scheduled by Urbis and conducted via Microsoft Teams ranging in duration from 30 to 45 minutes.

In parallel, ASEA contacted organisations for the purpose of data requests, followed by requests made by Urbis to other organisations.

Table 64 lists the parent organisations of the individuals who agreed to participate in stakeholder consultations, either via interview, provision of data or both, noting multiple people from one organisation may have participated.

Table 64. Stakeholder consultation participants

Parent organisation	Information gaps asked about
Australian Institute of Occupational Hygienists	• Workforce capacity, industry oversight and regulation
Department of Infrastructure, Planning and Logistics (NT)	• Risk profile of asbestos-containing materials
Department of Regional NSW, NSW Public Works	• Risk profile of asbestos-containing materials • Environment • Workforce capacity, industry oversight and regulation
Faculty of Asbestos Management Australia and New Zealand	• Risk profile of asbestos-containing materials • Workforce capacity, industry oversight and regulation
Fair Trading NSW	• Impact of asbestos on property values • Workforce capacity, industry oversight and regulation
SafeWork SA	• Risk profile of asbestos-containing materials • Workforce capacity, industry oversight and regulation
Sustainability Victoria	• Capacity and costs of asbestos waste • Environment
University of Sydney, School of Public Health	• Risk profile of asbestos-containing materials • Environment
University of Melbourne - Healthy Housing	• Environment
Victorian Asbestos Eradication Agency	• Risk profile of asbestos-containing materials
Workplace Health and Safety Queensland	• Risk profile of asbestos-containing materials • Workforce capacity, industry oversight and regulation
WorkSafe ACT	• Risk profile of asbestos-containing materials • Impact of asbestos on property values • Workforce capacity, industry oversight and regulation
WorkSafe NSW	• Risk profile of asbestos-containing materials • Workforce capacity, industry oversight and regulation
WorkSafe Victoria	• Risk profile of asbestos-containing materials • Workforce capacity, industry oversight and regulation

Urbis assembled an internal Expert Advisory Panel with expertise in public health, litigation impact, community impact and property valuation who also provided their insights and guidance throughout the evaluation. This included senior valuers each with over 20 years' experience, who shared insights on their separate areas of specialisation – residential developments, industrial developments and retail/mixed-use assets.

Appendix 4

Data Tables

Table 65. Training costs and duration

	Asbestos awareness		Working with asbestos		Class B Removal (Non-Friable)		Class A Removal (Friable)		Supervision		Assessor		
Provider	Cost (max)	Duration	Cost (max)	Duration	Cost (max)	Duration	Cost (max)	Duration	Cost (max)	Duration	Cost (max)	Duration	**Area**
Canberra Institute of Technology (CIT)	$190	4 hours	$355	4 hours	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ACT
Asbestos & you	$220	4 hours	$275	4 hours	$500	1 day	$850	1 day	$640	1 day	$1,800	2 days	SA
AlertForce	$227	4 hours	$397	4 hours	$297	1 day	$597	1 day	$297	1 day	$997	2 days	Vic., Qld, NT, WA, SA, Tas., ACT
AlertForce (NSW)	$227	4 hours	N/A	N/A	$397	2 days	$597	2 days	$297	1 day	$997	2 days	NSW
HIA (Qld)	$150	3 hours	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Virtual/national
CFMEU	$85	1 day	N/A	N/A	N/A*	N/A	N/A*	N/A	N/A	N/A	N/A	N/A	Vic.
MBA ACT	$270	4.5 hours	$525	4.5 hours	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ACT
Sydney Safety Training	$220	4 hours	N/A	N/A	$395	2 days	$575	2 days	$325	1 day	N/A	N/A	NSW
IWP Training	N/A	N/A	N/A	N/A	$400	1 day	N/A	N/A	N/A	N/A	N/A	N/A	NSW
All Global Training	N/A	N/A	N/A	N/A	$400	1 day	$950	2 days	$400	1 day	N/A	N/A	NT
Kallibr	N/A	N/A	N/A	N/A	$325	1 day	N/A	N/A	N/A	N/A	N/A	N/A	Vic.
WORKSAFE Connect	N/A	N/A	N/A	N/A	$390	1 day	N/A	N/A	N/A	N/A	N/A	N/A	Qld
HAZCON	N/A	N/A	N/A	N/A	$390	1 day	$420	1 day	$360	1 day	N/A	N/A	Vic.
Average cost and duration	**$199**	**Half day**	**$388**	**Half day**	**$388**	**~1 day**	**$665**	**~1.5 days**	**$387**	**1 day**	**$1,265**	**2 days**	

Source: List compiled by ASEA (2023).

** Note, Class A and B licences can be completed as a package for $850 over 5 days*

Table 66. ACMs by asset type

ACM type	Asset type	Proportion	Source
Cement sheeting – domestic	Residential	96%	ABS Estimated Dwelling Stock, 2022. Residential (excluding government)
Cement sheeting – domestic	Commercial	0	Assumption
Cement sheeting – domestic	Government	4%	ABS Estimated Dwelling Stock, 2022. Residential (government)
Cement sheeting – commercial	Residential	0	Assumption, analysed historical articles on assets targeted for asbestos
Cement sheeting – commercial	Commercial	50%	Assumption, analysed historical articles on assets targeted for asbestos
Cement sheeting – commercial	Government	50%	Assumption, analysed historical articles on assets targeted for asbestos
Flooring products	Residential	33%	Assumption, analysed historical articles on assets targeted for asbestos
Flooring products	Commercial	33%	Assumption, analysed historical articles on assets targeted for asbestos
Flooring products	Government	33%	Assumption, analysed historical articles on assets targeted for asbestos
Lagging	Residential	33%	Assumption, analysed historical articles on assets targeted for asbestos
Lagging	Commercial	33%	Assumption, analysed historical articles on assets targeted for asbestos
Lagging	Government	33%	Assumption, analysed historical articles on assets targeted for asbestos
Roofing products	Residential	33%	Assumption, analysed historical articles on assets targeted for asbestos
Roofing products	Commercial	33%	Assumption, analysed historical articles on assets targeted for asbestos
Roofing products	Government	33%	Assumption, analysed historical articles on assets targeted for asbestos
Other	Residential	33%	Assumption, analysed historical articles on assets targeted for asbestos
Other	Commercial	33%	Assumption, analysed historical articles on assets targeted for asbestos
Other	Government	33%	Assumption, analysed historical articles on assets targeted for asbestos

Table 67. ACMs by jurisdiction

Product type	Proportion of each product group consumed in each jurisdiction across the whole consumption period								
	ACT	NSW	NT	Qld	SA	Tas.	Vic.	WA	Australia
Cement sheeting – domestic	1%	37%	1%	15%	9%	3%	27%	8%	100%
Cement sheeting – commercial	1%	37%	1%	15%	9%	3%	27%	8%	100%
Cement pipes	1%	36%	1%	15%	9%	3%	27%	8%	100%
Flooring products	1%	37%	1%	15%	9%	3%	27%	8%	100%
Lagging	1%	37%	1%	15%	9%	3%	27%	8%	100%
Roofing	1%	37%	1%	15%	9%	3%	27%	8%	100%
Other	1%	38%	0%	15%	9%	3%	27%	7%	100%

Source: Brown et al. (2023)

Table 68. Proportion of ACMs by asset type

Asset type	Proportion in built form, 2023
Residential	58%
Commercial	20%
Government	22%

Source: Urbis calculation based on proportions in **Table 67** *and Brown et al. (2023)*

Cost–Benefit Analysis Methodology

The CBA informing this evaluation involved estimating the value of the positive impacts and costs which have been constructed based on the proposals put forward under options 2A and 2B. Urbis identified financial proxies to measure the value of social outcomes, developed approaches to value each proxy and apportioned the impact based on the anticipated level of impact. This results in financial values for social benefits that traditionally have not been given a financial value, such as avoided health impacts of asbestos exposure.

There are several techniques used to identify financial proxies and value outcomes. In this instance, evidence to support financial valuations has been provided by government guidelines, literature review and stakeholder engagement. Assumptions and methods of calculation are included in Chapter 5. This appendix includes specific calculations to supplement findings in Chapter 5.

Value of a statistical life

The value of a statistical life is calculated as that estimated in the Office of Impact Analysis' 'Value of statistical life' guidance note (2023) with inflation added so it is in FY2023 dollars (ABS, 2023b). That is:

$$\$227,000*107.1\%=\$243,117$$

Asbestos-related disease costs

The following key costs and data have been used to estimate the cost savings from reduced ARD incidence.

ARD deaths and incidence in Australia for 2019 were estimated using the GBD Compare Tool, as shown in **Table 69**.

Table 69. Proportion of ARD deaths and ARD incidence in 2019

Asset type	Proportion of deaths	Proportion of incidence
Mesothelioma	23%	22%
Asbestosis	4%	6%
Lung Cancer	70%	69%
Ovarian Cancer	2%	2%
Cancer of the Larynx	1%	2%

Source: GBD Compare Tool (IHME 2020)

The estimated health system cost of deaths and incidences of ARDs in 2016 were sourced directly from the CIE (2018), as represented in **Table 70**.

Table 70. Estimated cost of ARD deaths and ARD incidence in 2016

Asset type	Estimated cost per death	Estimated cost per incidence
Mesothelioma	$80,000	$39,500
Asbestosis	$118,700	Not available
Lung Cancer	$35,800	$14,300
Ovarian Cancer	$104,200	$8,800
Cancer of the Larynx	$55,500	$8,800

Source: The CIE (2018)

These costs have been escalated to 2023 terms using CPI as the inflator, with total inflation from 2016 to 2023 totalling 124.9%. This yields the estimated cost per death and per incidence for 2023, as reported in **Table 71**.

Table 71. Estimated cost of ARD deaths and ARD incidence in 2023

Asset type	Estimated cost per death	Estimated cost per incidence
Mesothelioma	$99,895	$49,323
Asbestosis	$148,220	Not available
Lung cancer	$44,703	$17,856
Ovarian cancer	$130,113	$10,988
Cancer of the larynx	$69,302	$10,988

Source: The CIE (2018), ABS (2023), Urbis Calculation

These costs were applied based on the proportions presented in **Table 69** to calculate the total estimated cost savings per avoided case. Growth in incidence was assumed to be in line with that calculated over the evaluation period for deaths due to ARD.