Australian Government
Asbestos Safety and Eradication Agency

ASEA REPORTS

Case studies of contaminated land

FINAL REPORT

As prepared by rawtec reincarnate strategic environmental consultants prensa

Asbestos Safety and Eradication Agency Report – 11-2017

Case studies of asbestos contaminated land

Final Report

Disclaimer

This report has been prepared for Asbestos Safety and Eradication Agency in accordance with the terms and conditions of appointment dated 20 February 2017. Rawtec has collected and collated information from public and confidential sources, most provided as secondary information and via stakeholder interviews. Whilst we are confident that this information reflects the projects outlined in this report, Rawtec Pty Ltd cannot accept any responsibility for use or reliance of this report or its contents by any third party.

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Contents

List of acronyms

ACM	Asbestos Containing Material
ACT	Australian Capital Territory
ASBINS	Asbestos in soils
ASEA	Asbestos Safety and Eradication Agency
NATA	National Association of Testing Authorities
NSW	New South Wales
NT	Northern Territory
OHS	Occupational Health and Safety
SA	South Australia
VIC	Victoria
WA	Western Australia
WHS	Work Health and Safety

Executive Summary

The Asbestos Safety and Eradication Agency (the Agency) has been established to facilitate a national approach to managing asbestos in Australia. Preventing the risk of asbestos exposure is the Agency's core purpose and this is delivered through the National Strategic Plan for Asbestos Management and Awareness. The plan provides a framework that supports each state and territory in working cooperatively and independently to achieve key objectives.

The sharing of knowledge and information on best practice management and removal of asbestos is essential in building government and industry capacity. As part of its role in delivering the national plan, the Agency has developed a series of case studies that aim to analyse existing practice, standards and guidance across Australia in the identification, registration and management of asbestos contaminated land.

The case studies aim to examine a variety of approaches to management of asbestos contaminated land (commonly referred to as ASBINS or "asbestos in soils") including:

- Approaches to site assessment, sampling and testing
- Development of conceptual site models
- Development of management plans
- Approaches to health and safety on site
- Removal, storage, transport and disposal practices
- Remediation
- Future land use

Methodology

The case studies have been developed in collaboration with key government and industry stakeholders, including:

- Research and targeted industry consultation to identify suitable projects for the development of case studies; in particular, projects that highlight areas of best practice and innovation;
- Shortlisting key projects based on their impact, availability of information and the willingness of stakeholders to be involved;
- Detailed consultation with stakeholders across the project life cycle;
- Developing comprehensive case studies of shortlisted projects using the information collected.

Key findings

This report presents seven case studies of removal and remediation of asbestos contaminated soils in a variety of settings, including large scale inner-city developments and regional landfill remediation. In constructing the case studies, Rawtec has sought to identify key themes and considerations relevant to this area of work. Some of the key findings from the project are summarised as follows:

Developing a clear business case for asbestos removal

The decision to remove asbestos contaminated soil must be made according to the business imperatives, community and stakeholder expectations and a long-term view of costs and benefits.

In several of the case studies presented in this report, the future land value of the site (after successful remediation) was the key factor in developing a business case for asbestos removal. For example, the asbestos remediation and installation of key services at Campbell Section 5 in Canberra cost the ACT Government some $15 million against an eventual sale price of $64 million. This represents an attractive return on investment and highlights the importance of understanding the estimated land value of a fully remediated site.

One of the most complex situations relates to a fire damaged property in the Lower Eyre Peninsula, South Australia, where asbestos contamination caused significant concerns for the local community. The site was privately owned and in the hands of an Executor as part of a deceased estate. In assessing its options for intervention, the District Council of Lower Eyre Peninsula estimated the value of the land at $200,000 against a removal cost of around $110,000. This supported a decision to enact the appropriate legislation to allow the clean-up of the site with the costs allocated back to the landowner for recovery after the land sale.

However, cost recovery is not always the primary driver. The business case for remediation of asbestos contaminated sites in and around Indigenous communities was driven by the need to protect the community from exposure risks and to support the return of heritage lands.

Key Finding: In all cases, a clear business case, which considers both qualitative and quantitative costs and benefits should be established to support decision making

Effective communication and consultation

The presence of asbestos at any site can raise concerns for the community, many of whom do not have the technical knowledge to understand the difference between real and perceived risks. Planned and professionally executed communication and consultation was a critical success factor in many of the case studies presented.

Ensuring communications are fit for purpose and appropriately targeted is also important. For instance, asbestos removal at landfill sites in the APY Lands, South Australia, required education and signage to be developed in the local language. In addition, given the high lack of awareness about asbestos risks in the area, a campaign of ongoing communication was delivered to ensure that the key messages were permeating into the communities.

The removal of asbestos contaminated soil at the Lyneham Sports Precinct, ACT, occurred in a highly visible area, adjacent to active sports fields and clubs. To support communication and education of users of the site, a Quick Reference Guide was developed which provided relevant information on the remediation program, affected areas, times that work was underway and other important information.

This highly informative approach led to increased community trust and acceptance of the project, therefore reducing incidence of complaint, concern and possible disruption.

Key Finding: Effective planning and communication is essential in ensuring community concerns are managed and thus reduces the chance of project delays arising from community complaints.

Maintaining flexibility and responsiveness during asbestos removal programs

Quantifying the degree to which soils are contaminated with asbestos can be challenging as sample pits may miss areas of contamination and surface samples may not highlight deeper areas of contamination. It is therefore common that significant additional asbestos containing materials are identified when soil is being stripped. The case studies show the importance of flexibility and good contingency planning to ensure that the project team can respond when and if additional asbestos is identified.

As an example, all key stakeholders of the Campbell Section 5 project in Canberra, including government regulators, worked together to develop a contingency plan for significant additional ACMs identified, including construction of a purpose-built containment cell for beneficial reuse material once remediated. Being flexible and responsive in this instance had a quantifiable benefit to the project through a near 25% reduction in project delivery times.

Similarly, an engineering and electronics company in Melbourne embedded contingency budget into their overall project to account for the likely identification of additional asbestos contamination during removal works. This approach ensured there were no delays in approving variation requests, keeping the project on track throughout.

Key Finding: Retaining flexibility in the project methodology and developing strong partnerships with regulators can buffer a project from unplanned delays and ensure that solutions to problems can be quickly addressed. Effective contingency planning, for both additional time and cost, can support project flexibility, especially in circumstances where the discovery of additional asbestos contamination during the project is likely.

Realising the benefits of on-site disposal options

In a number of scenarios explored in this report, asbestos contamination was visible within soils and options for on-site treatment and disposal were identified. Where this is possible and practical, considerable cost savings can be realised through reduced transport and disposal fees. Similarly, remediated or partially remediated soils can then be utilised within the project as clean fill or through beneficial reuse applications.

Remediation of Commonwealth land in the Cox Peninsula for instance was achieved in a cost-effective manner through the construction of a purpose-built containment cell for disposal of ACMs and other inert wastes. The Cox Peninsula is extremely remote and transportation and off-site disposal would not have been feasible. The engineered containment cell allowed the site to be remediated in a suitable manner in relation to its end use as park and recreational land.

A similar approach was used in the remediation of remote Aboriginal Community Landfills in the APY Lands, South Australia. Engineered containment cells were constructed at closed landfills and asbestos contaminated soils were disposed of in a safe manner. These cells are mapped via GPS coordinates to ensure they are not disrupted during any future work at the sites.

Key Findings: Where it is practicable to do so, on-site remediation and disposal of asbestos contaminated soils into engineered containment cells can support the business case for site remediation through reduced transport and disposal costs. This is particularly the case in rural and regional areas where transportation distances can be prohibitive.

Maintaining a strict focus on health and safety

Many of the case studies presented in this report highlight the importance of best practice health and safety and how this directly contributes to project outcomes.

The remediation of the former defence and communication site on the Cox Peninsula for instance implemented a stringent approach to monitoring and protecting the heath of site workers and the local community. Over 100,000 work hours on the project, just one list time injury was recorded. Measures included drug and alcohol testing, emissions monitoring and independent safety audits.

At Launceston Airport, the removal of friable, high-risk asbestos pipe lagging needed to occur whilst the airport remained operational. To ensure the health and safety of visitors to the site was maintained, a plant room adjacent to the contaminated area was developed into a purpose-built decontamination area, thus providing a single and controlled access and egress point that was separate from public space areas. In addition, a drill hole through the concrete floor of the plant room was used to feed in a vacuum system to reduce manual handling risks. Combined, these approaches directly reduced the project timelines to a concentrated 2-week removal period.

Key Finding: Maintaining a strong focus on health and safety may require additional up front planning time, however these are offset through reduced injury and lost work time and in some instances a faster overall removal time.

List of case studies within the report

The following projects are profiled as case studies within the report:

No	Project Name	Location	Overview
1	**Campbell Section 5 Remediation**	Canberra CBD, ACT	Remediation of large development site in Canberra CBD with some 52,000 tonnes of asbestos contaminated soil removed.
2	**Cox Peninsula Remediation Project**	Cox Peninsula, NT	Project of remediation at former Commonwealth defence and communication facility. Remediated land returned to Indigenous community.
3	**Launceston Airport**	Launceston, TAS	Targeted removal of friable asbestos contaminated soil from low clearance area in airport undercroft with plant room used to control access and egress.
4	**Lyneham Sports Precinct**	Lyneham, ACT	Highly visible redevelopment of sports precinct with associated asbestos in soil removal. Significant engagement with the community.
5	**Remote Aboriginal Community Landfills**	APY Lands, SA	Remediation of four landfill sites with planned on-site burial in targeted containment cells. Close engagement with local communities.
6	**Sleaford Mere Fire**	Lower Eyre Peninsula, SA	Asbestos contamination from bushfire damage leading to targeted asbestos removal and remediation via a cost recovery model.
7	**Asbestos Remediation Project in Clayton**	Clayton, VIC	Removal of more than 11,000 tonnes of asbestos contaminated soil from an industrial site in the south-east of Melbourne.

The following pages provide detailed case studies on the seven highlighted asbestos contaminated soils projects. They demonstrate effective planning and execution and the importance of productive relationships between industry, government and site developers in the effective and safe management of asbestos in contaminated land. It is hoped that these case studies will help share knowledge and demonstrate better practice with the broader industry and regulators to promote and encourage improved asbestos management across Australia and help reduce the risk of asbestos-related illness.

Campbell Section 5 Remediation



Case Study 1 – Campbell Section 5 Remediation

Project overview

Campbells Section 5 is a significant land development project in central Canberra. Significant asbestos contamination was identified, leading to a $15 million asbestos remediation and re-development project. Once completed, the site sold for $64 million. The project was undertaken in under two years and involved the removal of approximately 52,700 tonnes of asbestos contaminated soil. Despite discovering more than six times the originally estimated volume of asbestos, the project was completed 25 weeks ahead of schedule and only 5% above the original budget (approx.). Table 1.1 contains a summary of the key information from the project.

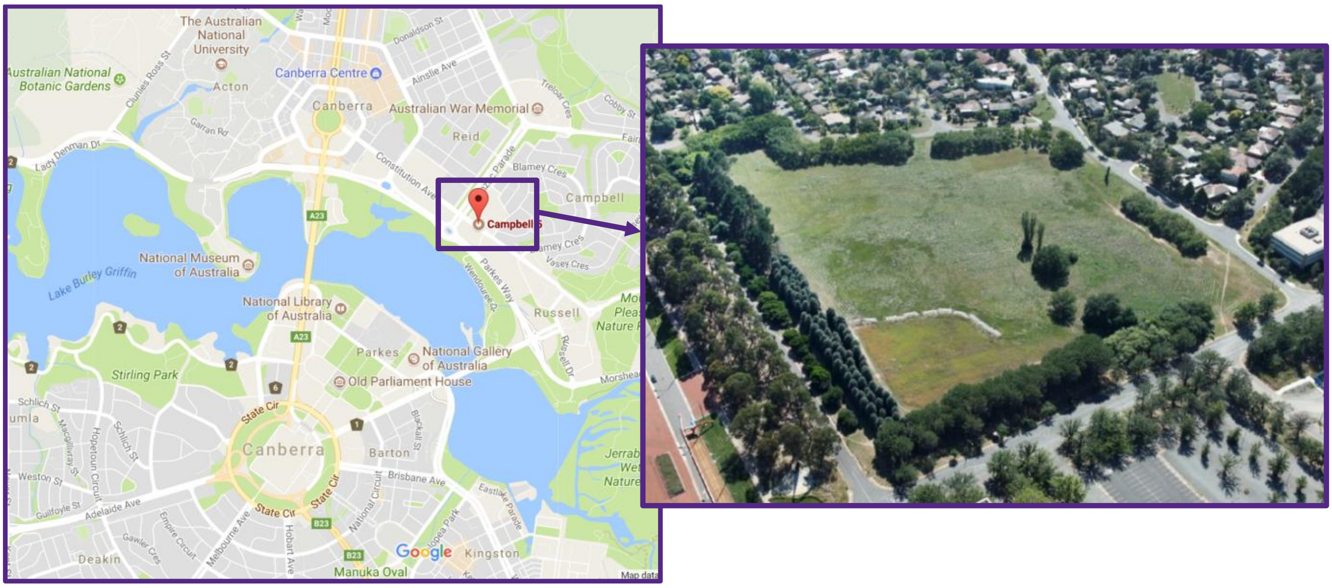
Table 1.1: Key information from the asbestos in soil remediation case study

Key information	Finding
Location	Constitution Avenue and Anzac Parade, Campbell, ACT
Removal period	September 2013 – March 2015
Type of asbestos	Asbestos containing building materials (bonded) including fibrous cement sheeting found in soils.
Volume	40,000 m^3 or 52,700 tonnes of ACM in soil including excavated soil.
Cost to remove	Approx. $15 million for asbestos removal as well as the development of infrastructure (roads, footpaths, sewerage system etc), Government funded
Distance from licensed landfill	West Belconnen Waste Management Centre, 22 kilometres from site
Key considerations for the asbestos clean-up	• Sensitive site with multiple stakeholders involved including dual government jurisdictions (ACT Government and National Capital Authority); • Significantly larger volumes identified during the removal than anticipated; • Work undertaken near residents; • Potential of contamination in the surrounding soil and the proximity of Lake Burley Griffin downstream.

Background

Campbell Section 5 is an estate located in Campbell, ACT, approximately 5 kilometres from Parliament House. In the 1800s, the site had a church and schoolhouse but in the 1900s the site became a disposal point for building materials from local developments, including asbestos containing materials (ACMs), which were buried at the site. The site later had trees planted and an informal open grass area for residents (see Figure 1.1).

Figure 1.1: The site prior to remediation work[1]



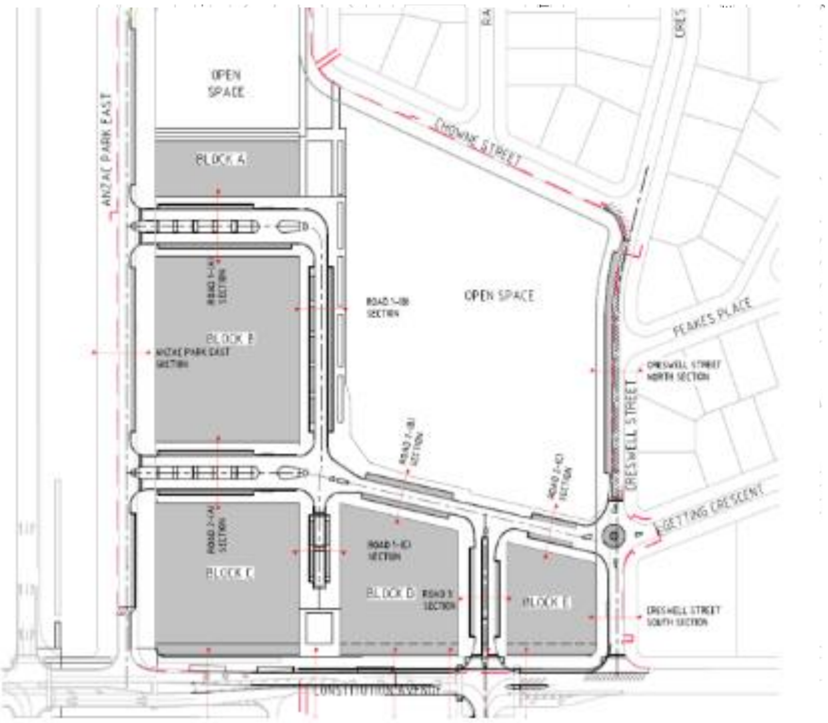
As the open space was built over a previous landfill, the surface was uneven and holes were emerging due to collapsible fill and rubble. These factors prevented Council from cutting the grass, and the site presented a significant hazard to the public. Given its location, the ACT Government realised the potential benefits of conducting a full site remediation, including improved safety for surrounding residents as well as the sale of the land for housing development. In 2010, the ACT Land Development Agency (LDA) began exploring options for developing the site and based on community consultation and design studies the LDA prepared a Master Plan which included:

- a new park;
- sustainable design in the public domain and within future buildings;
- a mix of building types with residential, retail and commercial uses; and
- a focus on pedestrian amenity and vibrant active streets (see Figure 1.2).

The LDA engaged a contractor to conduct the site remediation and to develop other required infrastructure, including roads, foot paths, services, parking bays and a steel pedestrian footbridge, to enable five sites to be sold for future development. This process commenced in 2013 and was finished ahead of schedule, in 2015, despite several challenges such as community concerns and the discovery of significantly larger volumes of asbestos than originally anticipated (see below).

[1] Map data: Google (left image)

Figure 1.2: Plans of the site, with the five development areas (blocks A through E), and open space.



Site sampling, assessment and project planning

Initial planning and site assessment

The site's well known history suggested asbestos contamination and the presence of other hazardous materials would be a barrier to future development. In 2011, an engineering firm conducted targeted subsurface investigations on contamination at the site. The assessment indicated that some topsoil filling and compacted layers of general fill, absent of gross contamination, was observed over a significant portion of the eastern half of the site. In the southern portion of the site the general and topsoil filling was also found to overlie filling containing building rubble and other rubbish and waste materials. The general and topsoil filling identified ranged from 0.3 m to 2.4 m below ground level. Initial inspections indicated that approx. 10,000 m^3 of soil containing asbestos was present at the site.

Based on this and the plans for the site, the LDA proposed a full site remediation and then development of the infrastructure above and below ground (roads, paths, sewerage systems etc). In 2013, the LDA contracted Robson Environmental and Canberra Contractors to conduct asbestos monitoring, an asbestos management plan, civil engineering works and remediation. The desired time to complete the project was 95 weeks.

Updated planning prior to commencement

Prior to commencing the work, Canberra Contractors identified that a full site remediation was not possible until other underground works were completed. For example, appropriate sewerage piping needed to be installed in some areas prior to remediation. Canberra Contractors recommended segregating the space into multiple areas and commencing works one area at a time. This allowed the largest areas of the site to be environmentally validated and infrastructure works to proceed, while more heavily contaminated areas could be slowly remediated in parallel. Despite an additional two months for approval, this approach saved time overall and was more effective.

Asbestos removal program

Overview of removal program

The initial site inspections indicated relatively low quantities of asbestos contaminated soil (approx. 10,000 m^3) across the site. The plan was to strip the overlying material across the site, delineating between contaminated soil and clean or BRU soil, such that the each could be treated accordingly (i.e. disposed of on site or re-used as fill material). However, as anticipated, higher volumes of asbestos were discovered during the early stages of the project (by the end of the project, 40,000 m^3 of asbestos contaminated soil was removed, see Table 1.2). The contractors also identified a large volume of unknown, low contaminated material. This material could not be re-used on the site, so was classed as beneficial re-use, or BRU. ACM was sent to an appropriate landfill, and the BRU material was buried and sealed in a containment cell in the open space. Remediation of the site was completed over 70 weeks, which was 25 weeks less than the planned completion time.

Table 1.2: Asbestos found at the site

Asbestos Type	Quantity	Locations
ACM (bonded) including fibrous cement sheeting containing ACM found in soils	40,000 m^3 or 52,700 tonnes	Spread across the entire site. Up to 5 metres below the surface.

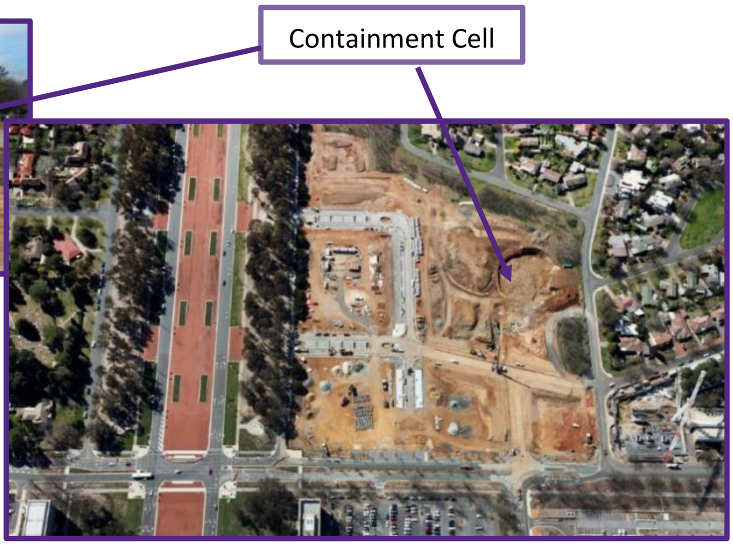
Stages of asbestos removal

Overall steps to remediating the site included:

1. Initial investigation and completion of a remediation action plan (RAP);
2. Commencement of remediation in September 2013. At this point it was decided that a ‘segregation’ method would be more effective and efficient than remediating the entire site in one step;
3. Contractors completed the remediation of the western portion of the site by May 2014;
4. As the works continued, Canberra Contractors found more asbestos containing material, as anticipated. In addition, significant volumes of unknown but low contaminated soil were also found (BRU);
5. The contractors adjusted the remediation action plan and Robson Environmental completed an asbestos management plan for ongoing management of the site. The contractors sought approval to build a containment cell for the BRU material, while ACM was transported safely to landfill;
6. Construction began on the containment cell for the BRU material (see Figure 1.3) in July 2014;
7. In August 2014, the contractors completed remediation of all subdivision blocks;
8. Contractors completed the remediation across the site by November 2014, with the open space reinstated with clean fill and the containment cell covered and secured;

9. Additional jobs were completed that arose during the project (removal of contamination under an adjacent main road;
10. Overall works (including building roads and pathways) completed in March 2015.

Figure 1.3: Construction of a 10,000 m^3 containment cell for low risk BRU material (left image), and the site in August 2014 (right image), with remediation complete on all subdivision blocks while infrastructure works were progressing.



Asbestos removal methodology

Initially, contractors remediated to a depth of 500mm below final design surface levels, incorporated a marker layer of geotextile over the base of the 500mm excavated area to indicate the interface between clean material and potentially contaminated material. However, after greater volumes of asbestos were discovered, contractors constructed the containment cell and removed asbestos by deep excavation (up to 5 metres) under full time supervision and observation of a suitably qualified environmental consultant. This was to ensure the excavated material was appropriately separated. Greater volumes of asbestos were anticipated, and the contingency plan was to address the issue when further details were known about volumes and types of hazardous material.

In response to the discovery, material was segregated into two piles: material that was ACM impacted (to be known as 'ACM waste'), and the remaining material, known as BRU material. Rather than wait for potential ACM waste to be tested, the environmental consultant identified potential asbestos, which was then placed in trucks, appropriately sealed and transported immediately off-site to West Belconnen Borrow Pit (WBBP). The remaining material was treated as BRU, and this was moved to the containment cell rather than re-used on the site.

The containment cell was used to reduce disposal costs for the remediation works, and was agreed upon with all relevant parties (the EPA ACT, National Capital Authority (NCA) and ACT Territory and Municipal Services (TAMs)). Clean material excavated to build the containment cell was used to build the internal roads, verges and cap the open space. Communication with government agencies was critical to ensure that the process was transparent and all aspects signed off from relevant parties.

All areas within the site were fully remediated, however due to the presence of existing services (water, sewer and communications), some ACM was capped and covered in the southern road verge where it was impossible to remove the asbestos material.

Key consideration for future projects

As an entire site cannot be tested, removalist companies may discover unexpected quantities or types of asbestos contamination under the surface. It is important to consider changing the approach from the original plan to ensure the asbestos can be removed safely, efficiently and cost effectively. If this occurs, it is also important to ensure sufficient and open communication with the client and other relevant stakeholders.

Figure 1.4: Asbestos contaminated soil along the southern boundary of the site (left image), an excavated section with up to 4 metres of highly contaminated soil underground (middle image, note the staff is 5 metres long), and asbestos containing material stuck to the outside of a concrete structure that was removed from the ground (right image)

Business case for asbestos removal

The business case for asbestos removal and remediation at Campbell Section 5 was driven heavily by the potential value of the land and sale price of the estate, as well as community safety. The removal of the asbestos contaminated soil and installation of infrastructure was approx. $15 million. All five sites in the Campbell Section 5 estate were sold by auction in May 2014 for a total of approx. $64 million. As such, the costs could be justified in the potential sale price.

In addition, after discovering the additional asbestos, costs were minimised through the development of a containment cell on site for all BRU waste. This enabled the contractors to dispose of some materials on-site rather than pay for transport and disposal costs at the local landfill.

Management of risks

The largest risk in this job was that future asbestos related issues at the site could arise due to ineffective management of significant volumes of unforeseen asbestos contamination. Prior to commencing, contractors anticipated larger volumes of asbestos at the site would be discovered, and the contingency plan was to wait for more detailed sampling to make an accurate assessment of how to move forward. In this case, after consulting the LDA and other stakeholders, a qualified asbestos inspector was utilised to enable efficient separation of excavated soil into ACM soil and BRU material. This allowed quick disposal of ACM soil, rather than needing to stockpile material and wait for test results. BRU material was disposed of in a certified containment cell which was sealed after use, and the ACM soil taken to a licenced landfill. This process saved on costs while remaining safe for residents and workers.

Other risk mitigation strategies included the use of appropriate fencing in surrounding suburbs to stop residents from entering the site, and the hygienist undertook daily air monitoring to ensure airborne asbestos levels remained acceptable. These results were reported to the project manager daily, and the levels of airborne asbestos never exceeded the maximum threshold.

Community concern and the project team's response

Although significant communication with residents took place prior to the project commencing, when works commenced, engagement with the community reduced. Residents raised this concern, and sought clarification and an update on the project to be kept 'in the loop'. In response, the LDA held an information session. This session provided concerned residents with an update on the project including actions taken to reduce risk, such as daily monitoring of airborne asbestos fibres. Robson Environmental and Canberra Contractors attended to provide information and answer queries. This received positive feedback from the community and allayed concerns while keeping residents updated.

Innovation and excellence

Despite the site's sensitive location, involvement of multiple stakeholders, deviation from the original remediation plan and the discovery of six times the volume of asbestos contaminated soil and other unknown materials, this project was completed 25 weeks ahead of the contracted time. Robson Environmental and Canberra Contractors also completed additional work in this time, removing contamination from below Constitution Avenue and re-surfacing this stretch of road.

The completion of works ahead of schedule can be attributed to:

- Segregating the area to enable a staged approach, rather than remediating everything at once. This allowed the largest areas of the site to be environmentally validated and infrastructure works to proceed, while more heavily contaminated areas could be slowly remediated in parallel.

Figure 1.5: Completed site and completed surface works prior to selling the development

- The construction of a containment cell within the open space area held 10,000m^3 of very low risk BRU material, which saved transportation time and costs, as well as disposal costs. The added benefit of not disposing of this material from site was that the 10,000m^3 of clean material that was excavated to create the containment cell was then used on the site to build and shape the internal roads and the cover to the park open space.

- Consultation with government was critical for a successful and efficient outcome. For example, a substantial volume of unexpected asbestos contamination was found on the southern boundary and this continued under the pavements. Although the original contract requirements dictated that the surrounding roads were to remain open, this was not possible due to the extent of the asbestos contamination. The contractors engaged in discussions to all levels of Government and other stakeholders to enable the surrounding roads being progressively closed to ensure the asbestos could be safely removed.

Cox Peninsula Remediation, Northern Territory

Case Study 2 – Cox Peninsula Remediation[2]

Project overview

The Australian Government owns several parcels of land on the Cox Peninsula that had been used for over 70 years for maritime, communications and defence purposes. A range of contaminants, including asbestos, that were present at the site were treated through a combination of removal from site and on-site management via an engineered containment cell.

The project presented a range of challenges, most notably the working conditions for contractors and meeting the expectations of stakeholders, including the traditional landowners who will progressively receive the land as localised areas of contamination are remediated.

Table 2.1 - Key information from the asbestos contaminated soil case study

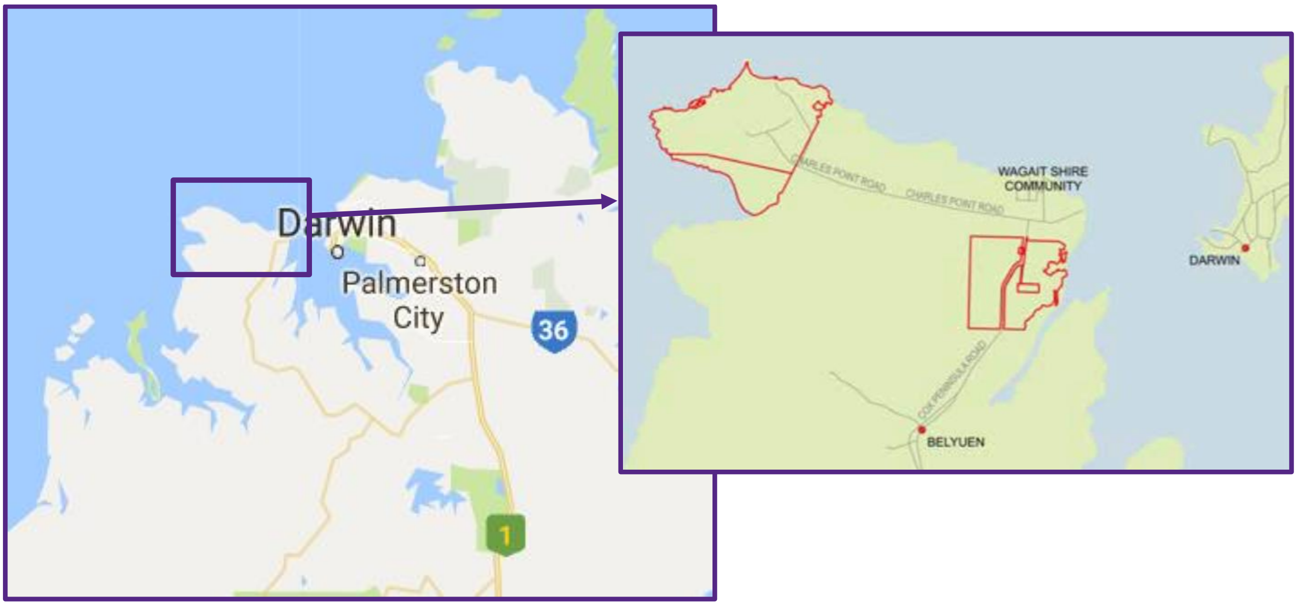
Key information	Finding
Location	Cox Peninsula, Northern Territory
Removal period	March 2016 – March 2017
Type of asbestos	Asbestos cement sheeting debris
Volume	28,000 m^3 of contaminated soil, including asbestos, lead, PCB and pesticides
Cost to remove	Total project cost of $31.5 million, of which asbestos management formed a part
Key considerations for the asbestos clean-up	• Construction of a containment cell for asbestos debris and other contaminants; • Removal of some asbestos contaminated soil to an offsite licensed landfill; • Consultation with a broad range of stakeholders.

[2] Map Data: Google Earth. Accessed 26th May 2017.

Background

Cox Peninsula is located on the western side of Darwin Harbour, 130 km by road and 10 km by ferry from Darwin (see Figure 2.1). Commonwealth-owned land covers an area of approximately 4,750 hectares.

Figure 2.1: Commonwealth-owned areas of Cox Peninsula indicated in red[3]



The Commonwealth had utilised the land on the Cox Peninsula for maritime, communications and defence purposes for 70 years (see Figure 2.2). The communications transmission and receiving station was made up of several buildings and other structures including communications towers, an extensive in-ground network of cables and service trunk lines, industrial and support buildings and a lighthouse.

There were also several tip sites across the land which contained a range of waste materials including building rubble from Cyclone Tracey. Asbestos was also located in some buildings that were on the site.

There was extensive contamination across a wide area both below and at ground level, including significant quantities of asbestos, and pesticides, heavy metals and polychlorinated biphenyls (PCBs) detected above safe levels at many sites.

At the time of the project, the Cox Peninsula was subject to an Indigenous Land Claim by the Kenbi Aboriginal People. The Commonwealth committed to remediate the land and return the land to a similar condition, as best as possible, to that prior to its Commonwealth use. This included removal of all buildings, communication towers and infrastructure, remediation of several tip sites across the land and protection of Indigenous and European heritage sites.

Figure 2.2 – Original Communications Station

[3] Map data: Google (left image)

Site sampling, assessment and project planning

Environmental consultants undertook extensive sampling on the contamination at Cox Peninsula, covering approximately 1,000 locations. All samples were analysed by NATA accredited laboratories. The overall site assessment works were also overseen by an independent Site Auditor.

The sampling identified waste materials including metals, asbestos containing materials (ACM) and oil drums (see Figure 2.3) on the ground surface. Below the ground surface, investigations also found ACM contamination in tip sites, general rubbish areas and in underground services.

Figure 2.3 – Discarded drums and pipes

Other contamination present included lead in surface soils from the degradation of lead-based paint; polychlorinated biphenyls (PCBs) associated with historic production of electrical transformers, flame retardants and sealants; hazardous materials in buildings and demolition waste; and pesticides beneath building slabs and in tip site areas. It was estimated that approximately 28,000 m^3 of contaminated material was present at the site.

The remediation plan for the site involved several phases:

- The demolition and removal of existing structures, including recycling of waste where possible
- The treatment of soils containing PCBs and pesticides via a thermal desorption unit
- The placement of ACMs and other inert wastes, including materials currently stored within shipping containers on site, into an engineered containment cell
- Rehabilitation of the remediated areas and ongoing monitoring of the containment cell

The majority of these areas will be remediated to an open space land environmental use standard, meaning the land will be returned to its natural state without any residual contaminants. The former Radio Australia Transmitter Station, where the containment cell is located, will be remediated to a commercial / industrial land environmental use standard. Future use of this area will need to consider the location and management of the containment cell.

Asbestos management program

Overview of management program

The asbestos management program was undertaken over a 12-month period from March 2016 to March 2017. In total, 28,000 m^3 of contaminated material was cleaned up and placed in secure disposal facilities.

Removal planning

In order to ensure the careful management and successful remediation of the site, a number of specialist firms were engaged. The roles of each of the experts covered a Project Manager and Contract Administrator, a Remediation Works Contractor, an Independent Site Auditor and a Technical Advisor. These teams worked closely together to plan out the remediation works to ensure works were cost effective and met the objectives of the project.

Removal methodology

There were three elements to the management of asbestos on the site. Firstly, the remaining buildings and structures on the site needed to be demolished. This was done in the conventional way with asbestos building controls implemented. Secondly, the asbestos conduit below the ground was dug up by an excavator (See Figure 2.4). Lastly, the contaminated soil located in the various tip sites on the Commonwealth land was excavated to remove the contaminated materials (see Figure 2.5).

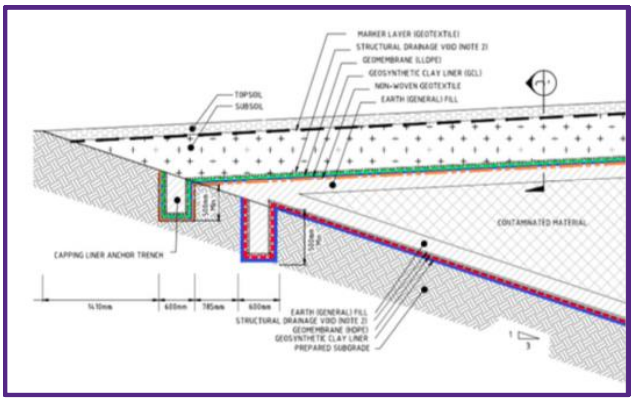
Figure 2.4 – Removal of buried asbestos conduit

Figure 2.5 – Rehabilitation of a tip site

A permanent containment cell was constructed on the site to encapsulate the contaminated materials for the Cox Peninsula remediation project. The containment cell measures approximately 100 metres by 100 metres in size, and up to a depth of 8 metres, and before excavation works began, redundant underground cables, including some asbestos pipes, were excavated and removed.

The area was excavated below ground and the base was lined with low permeability membranes. A collection system was installed to collect liquid that may leach out of the waste over time. Only inert materials were deposited in the cell, meaning very small quantities of leachate are likely to be generated. The containment cell was designed to mitigate leachate generation and to minimise leachate escaping.

Figure 2.6 – Concept diagram of containment cell liner and cap



Once the containment cell was filled, a cap was constructed over the top of the cell to encapsulate the material. The cap consisted of a low permeability membrane and a clay layer. The cell was then covered with some of the clean soil that was initially excavated to construct the cell (see Figure 2.6 for overview of containment cell construction).

Business case for asbestos removal

In a remote area with little development, the business case for asbestos removal at the Cox Peninsula site was not driven by potential future land values. Instead, the decision to remediate the area was driven by the need to protect the local community from potential exposure to hazardous materials and to meet the requirements of the Indigenous Land Claim. There was strong community and political support to fund what was ultimately a large remediation project.

The Indigenous Land Claim required the Commonwealth to hand back the land in a condition that was suitable for use by the local indigenous communities and potential future development. Overall, there was strong political will and the remediation project aligned with a number of government policy outcomes.

The overall cost of the project was $31.4M and although difficult to quantify, the benefits to the community through reduced risk and the return of Indigenous land to its traditional owners was deemed to justify the required investment.

Management of risks

One major challenge experienced during the project was the high level of mixed contaminants within the soils excavated from some of the tip sites. The project plan was to treat this soil for PCB and pesticide contamination using a direct thermal desorption unit. However, this was not possible for some of the tip soils due to the high level of asbestos present that would have introduced exposure risks.

Figure 2.7 – Asbestos stored in bags prior to disposal

Equally, the levels of PCB and pesticide contamination meant that the soil was also not appropriate for encapsulation within the containment cell that had been constructed. The most suitable method of management for this material was disposal to the City of Darwin's Shoal Bay Waste Management Facility, which had appropriate containment facilities.

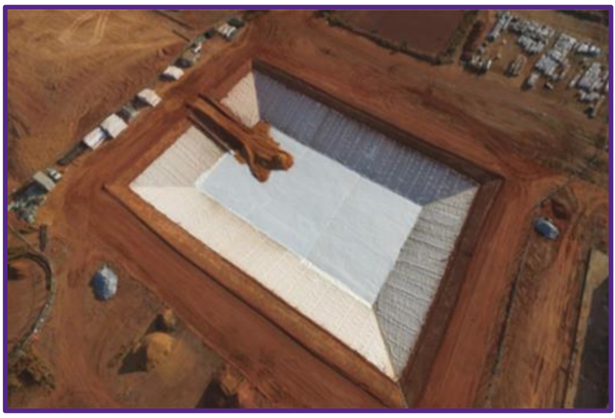
During the works, stringent measures to monitor and protect the health of site workers and the local environment were adopted. Approximately 100,000 work hours were completed on the project, with no lost time injury recorded. In addition, the project was subject to several independent safety and environmental audits. Monitoring activities included:

- Drug and alcohol testing
- Workforce exposure monitoring, including blood testing
- Emissions, dust and asbestos fibre monitoring
- Groundwater and environmental monitoring to measure impacts of remediation works.

To manage the risks associated with the containment cell, ongoing monitoring was undertaken during its construction. The monitoring included noise, odour, emission levels (air quality), soil and groundwater. The results were continually reviewed by project staff to ensure that compliance with regulatory requirements was maintained.

A Site Management Plan was also developed to manage the containment cell ongoing. As part of this plan, groundwater monitoring will be undertaken on a periodic basis to confirm there is no long-term impact on groundwater quality in the vicinity of the containment cell (see Figure 2.8).

Figure 2.8 – Containment cell



Innovation and excellence

Upfront and ongoing stakeholder engagement was key to the success of the Cox Peninsula Remediation Project. To get approval for the project, buy in and sponsorship by government stakeholders was critical. Stakeholders that were engaged during the project included the Department of the Prime Minister and Cabinet, the Northern Territory Government, the Northern Land Council, the local government Wagait Shire Council and the Larrakia people, the traditional land owners.

"Stakeholder engagement and communication is critical to ensure they understand the project and the end-product and accept any on-site solution. They also need to acknowledge and accept any ongoing responsibilities and be aware of future uses of the land."
Australian Government Department of Finance

Ongoing consultation included telephone updates, reference group meetings and site tours and meant stakeholders were getting updates on a regular basis.

Another of the key objectives of the project was to provide opportunity for active participation by local Indigenous businesses and individuals. For the duration of the project, Indigenous personnel contributed to approximately 30% of contracted workforce hours on the project. In addition, 16 sub-contractor work packages were awarded to Indigenous businesses registered with the Northern Territory Indigenous Business Network (NTIBN).

There was a strong focus on long term training, providing individuals with additional skills for the future, including first aid, low voltage rescue, groundwater monitoring, plant operation competency verification, risk management and asbestos awareness and removal.

Launceston Airport, Tasmania

Case Study 3 – Launceston Airport

Project overview

Launceston airport, located 15 kilometres south of Launceston, identified asbestos pipe lagging debris in sections of the soil beneath the main building. The airport consulted with licenced asbestos assessors and Worksafe Tasmania and decided on an appropriate soil removal method.

Over 300 square metres of asbestos contaminated soil was removed during an intensive 24-hour a day, two-week period. The main challenge overcome was the difficulty in accessing the small spaces beneath the building to safely and efficiently remove the soil.

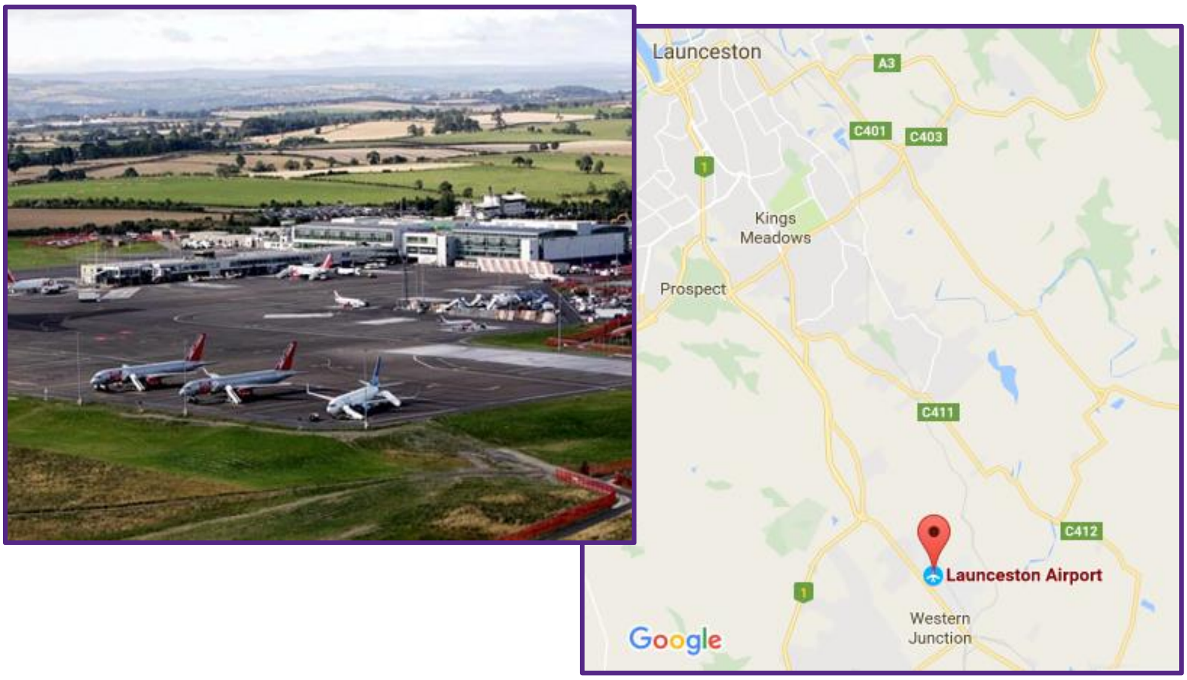
Table 3.1: Key information from the asbestos contaminated soil case study

Key information	Finding
Location	201 Evandale Road, Western Junction, Tasmania
Removal period	2-week removal period in March 2017
Type of asbestos	Amosite
Volume	Approx. 300 m^2 of contaminated soil containing asbestos pipe lagging debris
Cost to remove	Approx. $100k
Key considerations for the asbestos clean-up	• Sampling and testing of soil samples throughout undercroft of building; • Removal of 100mm of soil; • Scrape and vacuum method used to removal soil from under building to inside the enclosure.

Background

Launceston Airport is located in the north east of Tasmania, approximately 15 kilometres away from the main town of Launceston. The airport was established in the 1930s and the main terminal and associated services were constructed in 1965. There are currently three domestic jet services, two smaller regional services and regular jet air freight services in operation at the airport.

Figure 1 – Launceston Airport site location[4]



The airport asbestos register had been in place for many years and was reviewed on an annual basis. However, there were some areas that were considered too difficult to access for the purposes of the survey and this included the crawl space area under the terminal building, known as the undercroft.

In 2016, a maintenance worker identified a white substance within the soil in the undercroft beneath some insulated pipework. The airport had a sample of this substance tested at a NATA certified laboratory and it was confirmed as amosite asbestos.

Figure 3.2 – Asbestos debris found in the soil

[4] Map data: Google

Site sampling, assessment and project planning

The initial response by Launceston Airport was to isolate the undercroft area with no access allowed and appoint a licensed asbestos assessor to investigate the extent of the contamination. The assessor found that there was a mix of both older asbestos and newer non-asbestos lagged pipework in the undercroft, with asbestos debris visible under and around the older pipework areas. The assessor took soil samples under both the old and newer pipework areas for testing at a NATA certified laboratory. Results showed that asbestos contamination was present in both areas, indicating some ineffective historical removal of old asbestos-lagged pipework and replacement with newer pipework.

Figure 3.3 – Part of the remaining asbestos-lagged pipework

Launceston Airport engaged 2 assessors to provide advice on the management of the asbestos and both provided asbestos control plans and quotations for the full removal of the contamination as well as the remaining asbestos pipe lagging. A meeting was then arranged with both assessors as well as WorkSafe Tasmania to discuss the scope of the work, including the overall approach, the removal methods, what sampling and testing would be undertaken. Throughout the process Launceston Airport needed to consider the costs of the proposed options and get business approvals on the expenditure. Overall it took almost 6 months of consultation and preparation to finalise the removal methods.

As part of the planning process, the licensed assessor identified the locations of the removal site, the enclosure and decontamination areas, the storage location for contaminated soil and asbestos pipe lagging and the access routes for daily access and emergency egress.

The removal works were planned in a way that confined all activity to the undercroft and adjacent areas and did not affect airport customers. This allowed the airport to continue to operate as usual for the duration of the removal works.

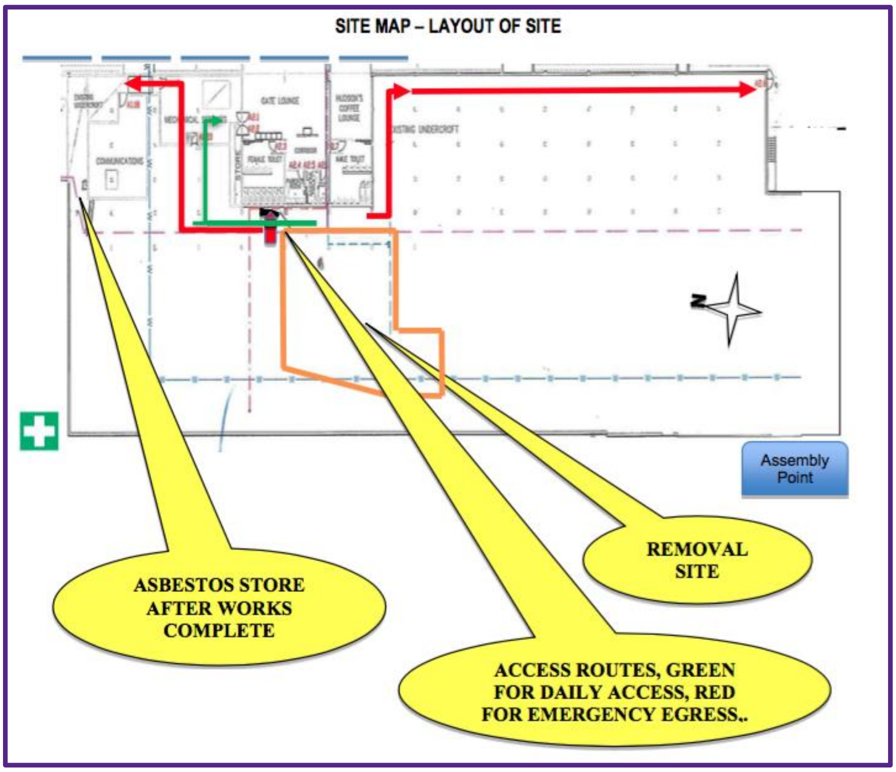


Figure 3.4 – Site map in the asbestos removal control plan

Asbestos removal program

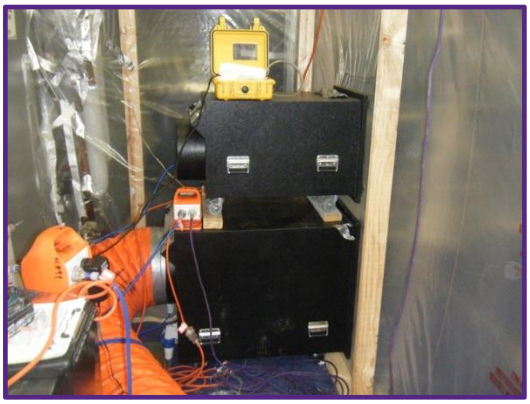
Overview of removal program

The removal program was an intensive program with 24 hour-a-day work conducted over a two-week period. Overall, there was 300 m^2 of asbestos contaminated soil and pipe lagging removed from the undercroft of the terminal building.

Removal planning

In order to isolate the asbestos works from the rest of the airport, the removalist cleared out an existing plant room and constructed an asbestos enclosure within the plant room itself. This allowed the asbestos signage to be located within the plant room and all project workers to be able to access the area directly from the car park and not through the main terminal building. The plant room was also fenced off to restrict unauthorised access. The enclosure was set up under negative pressure and also housed a vacuum system which was to be used for the asbestos removal. In this way, the plant room was used as a load point and transfer point for the soil (see Figure 3.5).

Figure 3.5 – Decontamination unit and enclosure used for the project



In addition to the soil removal preparation, glove bags were set up to remove the lagging from the old pipework, with plastic sheeting laid underneath.

Removal methodology

Asbestos contamination was remediated by removing the top 100mm of soil in the affected areas. Where the ground was hard clay, it was reduced to a sufficient level to allow the soil to be decontaminated properly.

During the planning and removal phases, consideration was given to the challenges associated with working in the crawl space. This included safe access and egress, appropriate PPE such as knee pads and head protection, and the use of additional lighting to ensure workers were able to see.

The soil was removed with a combination of hand scraping and vacuuming. The vacuum unit was introduced into the undercroft space by core drilling through the concrete floor in the enclosure and passing the vacuum hose through. Additional asbestos lagging was also removed from pipe lagging using the glove bag method. A PVA solution of five parts water to one part glue was also used on bearers and ledges and the grounds surrounding the removal area.

Once work in an area was complete, the hygienist undertook a visual inspection and took soil samples for testing. In some instances, asbestos was found to still be present, so the removalist needed to return to those areas and undertake further work.

Figure 3.6 – Restricted access to the plant room and undercroft area

Soils that were removed by vacuum were collected in drums and bags inside the enclosure. Once full, the drums and bags were decontaminated using a wet wash and glue spray. These were then stockpiled until they could be removed after hours using an EPA licenced vehicle.

For the duration of the removal process an occupational hygienist was engaged to undertake continuous air monitoring. Air monitoring stations were located outside the removal areas as well as within plant room.

Business case for asbestos removal

In assessing the business case for asbestos removal works, Launceston Airport considered the risks to staff and contractors accessing the undercroft area against the total estimated costs. The levels of contamination and the type of friable asbestos material meant that no personnel would be able to access the undercroft area safely. As such, the decision to remediate the area was made on this basis. The removal of the contaminated soil areas as well as the remaining asbestos insulation on pipework cost in the order of $100k.

Management of risks

The airport needed to remain operational throughout the asbestos removal works, meaning the project was particularly sensitive. Thorough planning and the decision to use the plant room as an isolated access and egress point meant that the undercroft works were able to be conducted without risk to airport customers.

Consultation was also crucial to the success of the project. The meetings held with assessors and Worksafe Tasmania upfront ensured that the methodologies used were effective in cleaning the soil but also did not impact on airport operations. The airport was kept up to date with progress of the project through daily communication of air monitoring results and work progress.

Innovation and excellence

The height of the undercroft area ranged from approximately 300 mm of crawlspace to head-height. This made it difficult for workers to access the area and in particular to collect and remove large amounts of soil.

In order to overcome this, the asbestos removalist core drilled through the concrete floor in the plant room and fed through the vacuum system into the undercroft area. This allowed removalist workers to use the vacuum on the soil and during the removal of the remaining asbestos pipe lagging to remove the material directly into the asbestos enclosure. This eliminated the need for manual handling of materials and reduced the overall time needed for the work.

Figure 3.7 – Vacuum unit located inside the enclosure

Lyneham Sports Precinct

Case Study 4 – Lyneham Sports Precinct

Project overview

The Lyneham Sports Precinct asbestos removal project was a large-scale and very public asbestos in soil project in the ACT. The ACT Government undertook a planned, risk-based and cost-effective strategy to remove the asbestos contaminated soil, which was estimated to be over 13,000 tonnes. The considered approach led to cost savings from the originally budgeted $6.5 million to $3.5 million, and the site is now appropriately remediated for future works. In addition, this project led to more effective recording of asbestos contamination in the ACT, an area which required some improvement.

Table 4.1: Key information from the asbestos contaminated soil case study

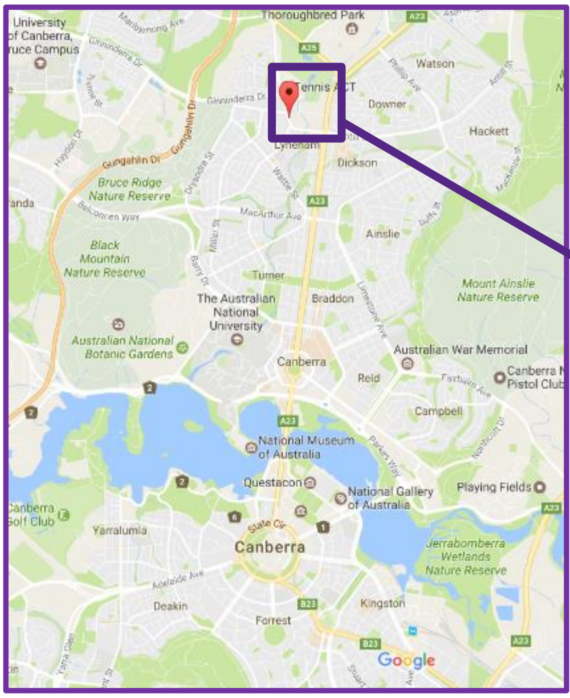
Key information	Finding
Location	Corner Mouat Street and Northbourne Avenue, Lyneham, ACT
Removal period	Identified in 2011, remediation commenced in 2013, completed in 2013.
Volume of asbestos	Approx. 13,200 tonnes of asbestos contaminated soil
Cost to remove	Approx. $3.5 million, government funded
Distance from licensed landfill used for disposal	16 kilometres, West Belconnen Landfill
Key considerations for the asbestos clean-up	• A high level of public scrutiny given the location and relevant stakeholders; • Requirement to follow WA regulations, different from NSW regulations; • Poor government records provided the opportunity to improve government record keeping and Transport Canberra and City Services now maintains a register of dumping of materials in open spaces in the ACT.

Background

The Lyneham Sports Precinct is a 13.2-hectare sporting area in the ACT. It is home to a variety of sporting clubs, including Tennis ACT, Hockey ACT, Netball ACT, Canberra Archery Club and Volleyball ACT. A golf club is also situated adjacent to the site. The entire site is managed by the Sport and Recreation services, a government directive.

The ACT Government commenced a Lyneham Sports Precinct major upgrade in 2009. This included upgrades to lighting, irrigation, playing surfaces, carparks, netball court surfaces and installation of stormwater works. During the upgrade, asbestos containing materials (ACMs), including building rubble which had been dumped in the 1950s to 1970s, were found in a creek line that had playing fields built over the top. The upgrade to the sports precinct was put on hold until the asbestos was appropriately managed.

Figure 4.1: Location of the Lyneham Sports Precinct in proximity to Canberra and map of Lyneham sports precinct with one of the locations that asbestos was discovered (red box)[5]



[5] Map data: Google (left image), Lyneham Sports Precinct map sourced from http://www.abc.net.au/news/2011-10-05/map-of-lyneham-sports-precinct/3300086

Site sampling, assessment and project planning

Completion of sampling and remediation action plan

When asbestos was identified on the site, the EPA and WorkSafe ACT were notified and construction ceased. The ACT government engaged an environmental consultant in 2011. In total, this contractor completed 10 environmental site assessments and a Remediation Action Plan (RAP). Significant testing and site sampling was undertaken to enable a clear picture of the extent of the asbestos contamination and to ensure the ACT government could consider low risk but cost-effective methods for removal, based on an understanding of the site's contamination. Although this took some time, it led to a more efficient and cost-effective outcome in the long term.

Key consideration for future projects
Significant sampling, testing and a risk-based and cost effective focused Remedial Action Plan ensured the extent of the asbestos contamination was known in the early stages, and the works could be undertaken efficiently, safely and cost effectively.

A summary of the type and location of asbestos identified during the site assessments can be found in Table 4.2. The Sports Precinct upgrade contractors had already remediated and stockpiled soil from Zone A, although testing of this material indicated that soil from this zone did not contain asbestos. Zones B and C were found to have ACM in the upper 250 mm of soil. A 'hotspot' was also identified with increased concentration of building debris (see image 2 in Figure 4.2). Based on this analysis and requirements of the upgrade, the contractors updated their remediation procedure to consider the removal of ACM in the soil, and a Remedial Action Plan (RAP) was developed.

Table 4.2: Asbestos identified at the site

Asbestos Type	Quantity	Locations
Amosite (Brown), Chrysotile (White) and Crocidolite (Blue) in pipes and cement sheets.	Approx. 13,200 tonnes	Zones B and C (see Figure 4.2). Found in building rubble buried in the soil.

Asbestos removal program

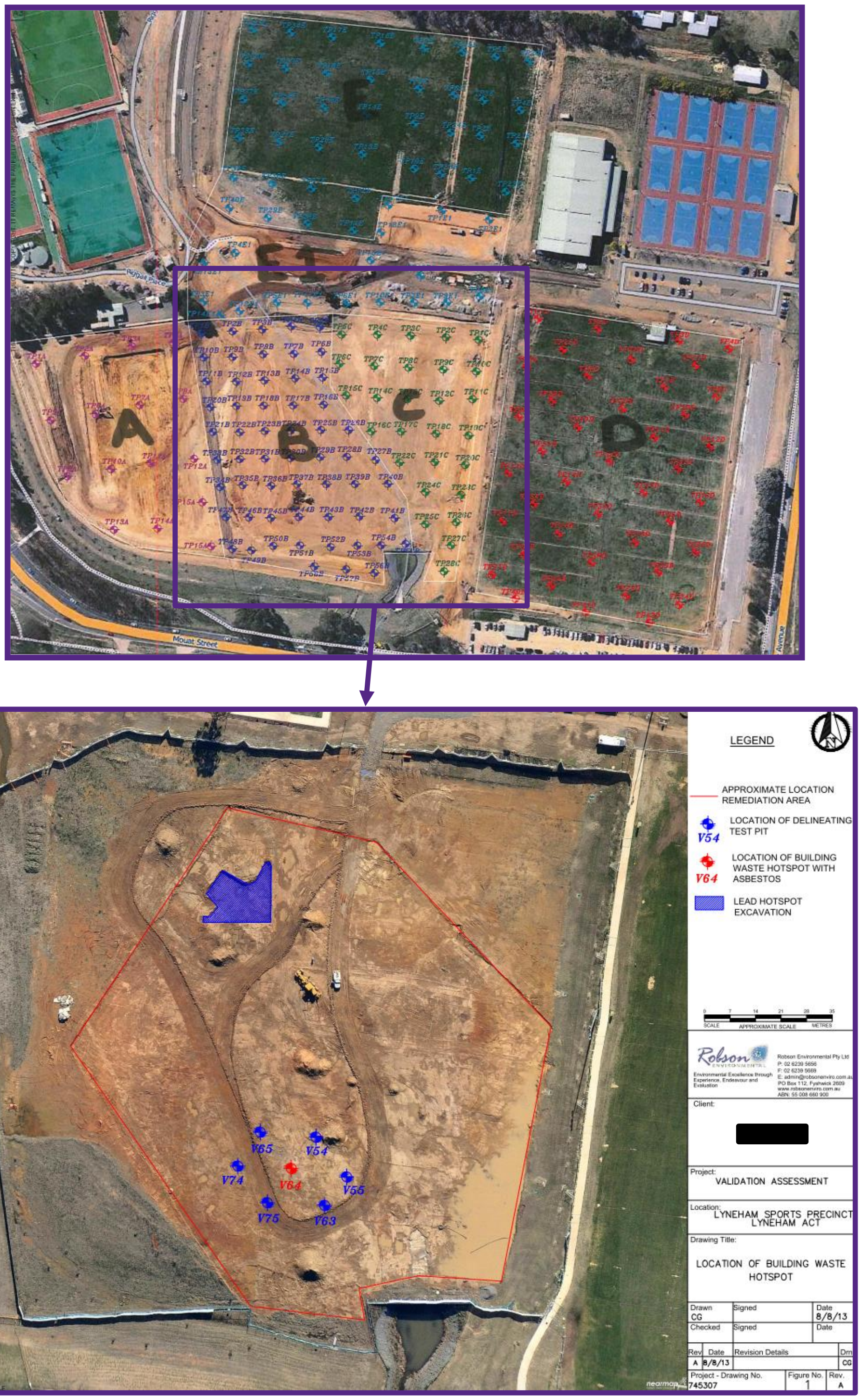
Overview of the program

As ACM was identified in the top 250 mm of soil, it was recommended that the top layer to this depth be removed from a significant area within Zone B and C, as well as removal of the asbestos in the 'hotspot' (see image 2 from Figure 4.2). Approximately 13,000 tonnes of asbestos contaminated soil was excavated and safely removed from the site while other sporting areas continued to hold sporting activities. The asbestos contaminated soil was transported to the local licenced landfill, 16 kilometres away.

Site plans

Site plans are presented in Figure 4.2. These images highlight each 'Zone' in the sports precinct that was to be upgraded, and the location of the asbestos contaminated soil (in Zones B and C).

Figure 4:2: Sites that were being upgraded (top image, Zones A - E), and location of ACM soil (remediation area, bottom image, red line) and asbestos waste 'hotspot' (bottom image, red dot)



Removal methodology including set up and planning

The process undertaken to safely remove the asbestos contaminated soil included:

1. Engagement of an Environmental Consultancy to complete numerous site assessments (including pot holing and air monitoring), and eventually develop the RAP based on findings.
2. Set up site:
    a. Fencing with signage to prevent public access;
    b. Set up sediment and erosion control measures such as hay bales and black plastic under stockpile areas;
    c. Setting up a decontamination zone and monitoring equipment;
    d. Clearly defining haul routes for the transportation of soil off and onto the site.
3. Removal of contaminated soil:
    a. Environmental Consultant conducted air monitoring;
    b. Excavating soil in identified asbestos contaminated areas (to 250 mm);
    c. Use of water to control dust levels;
    d. Asbestos soil was transported by leak proof trucks to an asbestos licenced facility;
    e. Other soil was tested to ascertain whether it could be re-used elsewhere or on the site (known as BRU, or beneficial re-use), or should be disposed.
4. Validation sampling:
    a. After the removal of 13,200 tonnes of asbestos contaminated soil (see Figure 4.3 for an example), Environmental Consultants undertook a clearance inspection on the remediated area;
    b. A permeable geotextile barrier was installed as an indicator of the presence of underlying impacted soil.
5. Reinstatement with suitable fill material (250 mm layer across the remediated area):
    a. Assess the suitability of the fill material;
    b. Obtain approval to re-use BRU soil;
    c. Place imported suitable material or approved BRU soil over the geotextile barrier.

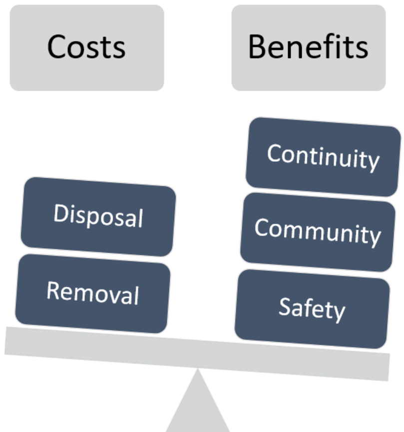
Figure 4.3: Asbestos contaminated soil found at the site

Communication with stakeholders

Stakeholder management and communication was one of the most important factors during this project. Before commencement of the asbestos removal works, the ACT government notified the Archery Centre, WorkSafe ACT, EPA ACT, sub-contractors, sports precinct employees, players and any persons either visiting or operating near the site works.

An example of the designated communication approach is the development of a 'Quick Reference Guide'. This included remediation commencement dates, affected zones, tonnes to be removed, where the soil was being disposed, times of excavation and truck movements (between 7.30am and 3.30pm, Monday to Friday), entrance and exit location for trucks and risk mitigation measures implemented (fencing, wetting down of material).

Business case



The identification of asbestos at the Lyneham Sports Precinct was unplanned and not factored into the original cost of the development. Once discovered, sampling and testing revealed significant additional time and cost for remediation works. An initial option discussed was to build over the top of the asbestos contaminated soil, leaving it in-situ.

After weighing up the costs and benefits of removal, it was decided that full remediation of the site outweighed the additional costs and delivery time. The key driver in this decision was community safety and effective long-term planning, recognising that future upgrades to the site would be required. The additional funding for asbestos removal was estimated at $6.5 million, however through effective planning and development of an RAP, the ACT Government was able to reduce this estimated cost by approximately 45% (from $6.5 million to a cost of $3.5 million).

Management of risks and use of regulations

Risks and regulations considered in this project are summarised in Table 4.3 below.

Table 4.3: Risks and regulations identified and mitigation strategies

Risks and regulations identified	Risk mitigation strategies
Public access to surrounding sporting areas	• During the process, complete fencing of the remediation zone was used (1.8 m high), with shade cloth and signage erected; • The public were informed of the works including the locations and period of removal, and access to areas adjacent to the remediation zone were limited to weekdays after 5pm and weekends; • Access and egress into the relevant zone was via one point, which was controlled by a trained gate person.

Potential for asbestos to become airborne and be breathed in by workers or the public	• The asbestos removalists were required to wet down during works and at the completion of each day (and weekends as required); • Environmental Consultants constantly undertook air monitoring; • Cessation of works during high wind conditions; • All vehicles were washed down with a jet wash before leaving site; • Truck operators had to close off windows and ventilation systems; • All truck movements in and out of the site were recorded; • Correct PPE was compulsory and worn at all times.
The contractors originally engaged to upgrade the facility were not trained in asbestos removal	• When asbestos was identified, the ACT Government engaged an Environmental Consultancy to assess the site and complete a RAP; • All contractors who were involved in the asbestos removal were appropriately trained, with a Class A Assessor on-site throughout; • In addition, all personnel leaving or working in the remediation area undertook a Site/Area Specific induction.
Fear and worry of the community	• The ACT Government undertook extensive signage, testing and communication with the community on the risk levels; • Regular air monitoring was undertaken, and the results were communicated to the community to reduce fear and to build trust.
Example rules and regulations followed (note this included ACT, NSW and WA Acts and Guidelines)	To ensure the highest levels of safety and better practice, removalists considered numerous regulations and guidelines, including: • Contaminated Sites Information Sheet No. 4, *Requirements for the Re-use and Disposal of Contaminated Soil* (ACT EPA, 2011); • The NSW Office of Environment and Heritage *Guidelines for Consultants Reporting on Contaminated Sites*, (OEH, 2011); • Western Australia Department of Health, *Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia* (WA Guidelines), (DOH, 2009)[6].

Innovation and excellence

The project team demonstrated innovation and excellence across the entire project. Examples include:

- The planning and management of asbestos removal during the project informed new approaches to asbestos record keeping in the ACT. This project directly led to Transport Canberra and City Services maintaining a register for asbestos in open spaces in the ACT that is easy to access when required;
- The cost to conduct the asbestos removal works was approx. $3 million less than the $6.5 million originally budgeted with savings achieved through significant testing and planning;
- The project was completed in a public sporting precinct. Despite the public concern, neighbouring sports could be safely played throughout the project, and the ACT Government could build trust with the community through proactive and transparent communication.

[6] Note that the ACT is required to follow WA guidelines for asbestos site remediation, not NSW guidelines.

Remote Aboriginal Community Landfills, South Australia

Case Study 5 – Remote Aboriginal Community Landfills, South Australia

Project overview

The South Australian Government found that ten landfills in the Anangu Pitjantjatjara Yankunytjatjara (APY) Lands in the remote north west of South Australia were contaminated with asbestos containing materials (ACMs).

The ACM was scattered around the landfills, often amongst piles of building rubble, soil and hard waste. As the ACM was mixed with other wastes and partially within the soil, on-site management strategies for identified ACM were implemented at each landfill.

Culturally sensitive communication and consultation with the local Indigenous communities on the risks of asbestos was one of the key successes of the project.

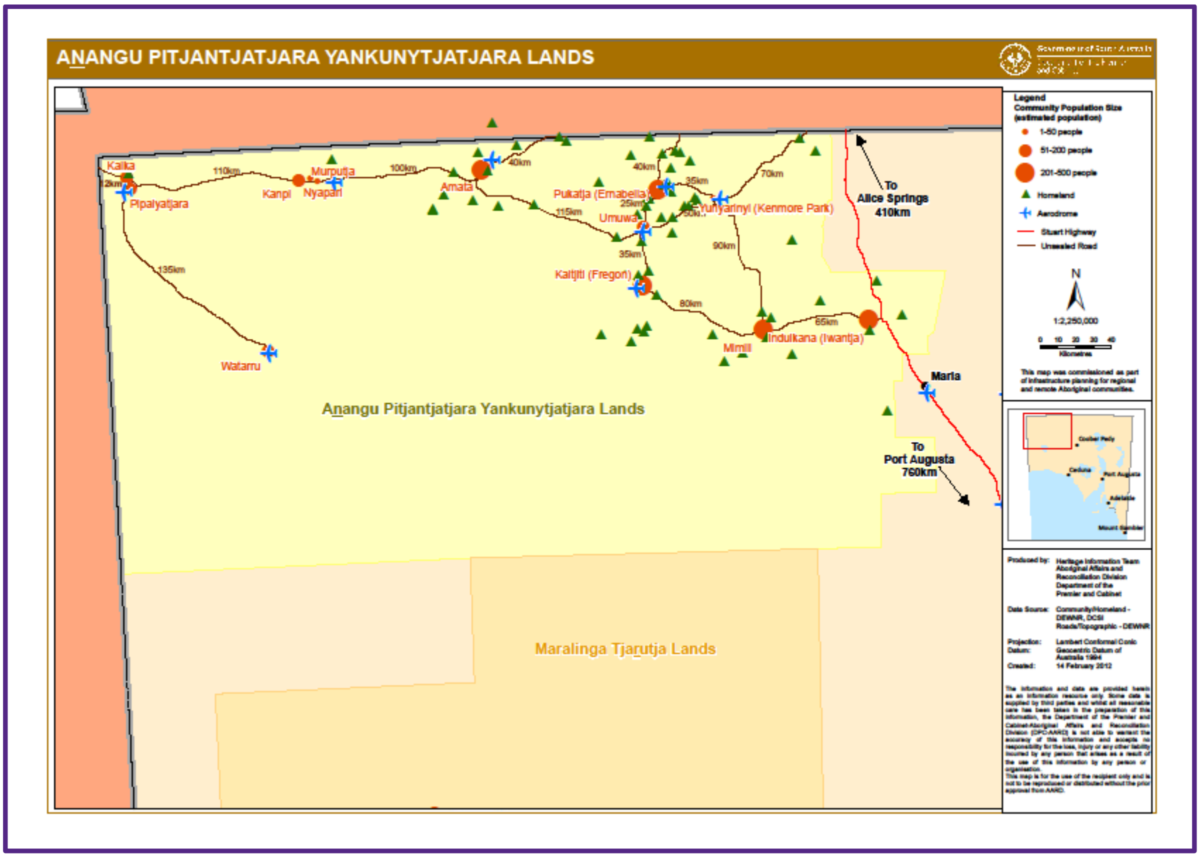
Table 5.1: Key information from the asbestos contaminated soil case study

Key information	Finding
Location	APY Lands, South Australia
Removal period	Mid-2014 to early-2017
Type of asbestos	Asbestos cement sheeting debris
Volume	At four of the landfill sites approximately 387,000 m^2 of land was cleaned up
Cost to remove	$3.6 million over three years to work on improving landfills and waste management on the APY Lands
Key considerations for the asbestos clean-up	• On-site burial and containment of asbestos containing materials; • Closure of existing landfills and establishment of new ones; • Communication methods with local Indigenous communities.

Background

The APY Lands cover an area of around 103,000 square kilometres in the north west of South Australia, stretching from the Stuart Hwy to the Western Australia border (see Figure 5.1). The most prominent features on the APY Lands are the Tomkinson, Mann, Musgrave and Everard Ranges, with most of the communities located in or around these ranges. It has a population of around 3,000 people.

Figure 5.1 – Anangu Pitjantjatjara Yankunytjatjara (APY) Lands



In response to a report '*Waste Management in the Anangu Pitjantjatjara Yankunytjatjara Lands (The APY Lands): Past, Present and Future - The Rubbish Report*'[7], the South Australian Government provided funding of $3.6 million over three years to work with APY on improving landfills and waste management on the APY Lands. The report outlined that landfills in the area were built more than twenty years ago, were generally full to overflowing and had quantities of mixed hard waste. The extent of asbestos-containing materials at the time was not known.

[7] APrince Consulting 2011. The Rubbish Report Waste Management in the Anangu Pitjantjatjara Yankunytjatjara Lands (The APY Lands): Past, Present and Future, *Anne Prince Consulting,* June 2011

Site sampling, assessment and project planning

The South Australian Department of Planning, Transport and Infrastructure surveyed the landfill sites, specifically searching for and testing waste materials suspected of containing asbestos. Samples were taken where suspected asbestos material was present.

The surveys involved creating GPS tracks around the greater landfill area and tagging the locations where samples were taken, as can be seen in Figure 5.2.

Figure 5.2 – GPS mapping of sampling of landfill area

The report’s findings included:

- Ten of thirteen landfills inspected on the APY Lands were confirmed to have asbestos containing material (ACM). Aside from a small piece of friable millboard at one site (which was covered immediately), ACM confirmed at all sites was in bonded, non-friable form, and included a variety of asbestos-containing fibre cement sheeting materials; brake shoes and linings on older dumped vehicles; and polymer material in joint mastic on old rainwater tanks dumped at the landfill sites.
- The distance of APY landfills to their respective community’s ranges between 2 - 5 kms, minimising access to each site.

Asbestos management program

Overview of management program

Accurately quantifying the total amount of the different ACM forms identified was difficult, particularly at the larger landfill sites, given that most of the waste material was mixed with other building and general waste material, or was partially buried in soil mounds. It was considered highly likely that more ACM was present in other parts of the landfill sites, in old landfill trenches and in other disturbed areas at the sites.

Figure 5.3 – Typical condition of the landfill sites at the start of the program

The ACM was scattered around the landfills, often amongst piles of building rubble, soil and hard waste. Samples had only been taken from above ground and as such the amount of hidden ACM was unknown. Much of the ACM is considered to have originated from government funded housing and building construction dating back several decades.

The short-term approach to managing the landfill sites was their immediate closure, with temporary signage erected. This was followed by the installation of more permanent hazard and warning signs in English and in the appropriate Indigenous language.

Figure 5.4 – Examples of temporary and permanent hazard signs

In order to develop medium and long term solutions, a number of meetings were held to discuss remediation methods. This included liaising with the APY Board and evaluating risk management strategies. The result was the decision to broaden the areas around the landfill sites for remediation. The landfills at four of the sites were relocated elsewhere..

Figure 5.5 – Pilpalyatjara landfill site with clean-up boundaries indicated

Figure 5.6 – Mimili landfill site after clean-up

The APY Waste and Landfill Program included cleaning up and closing existing landfill sites and constructing new landfills at nine communities. The Asbestos Safety and Eradication Agency contributed funds towards the clean-up of four community landfill sites – Iwantja, Pukatja, Kaltjiti and Pipalyatjara. The clean-up involved the collection of the above surface hard waste, including the asbestos containing materials and burying the waste within the confines of the existing landfill. The site was then capped to provide a barrier to prevent asbestos materials from coming to the surface over time, and the area clearly identified with new signs.

The total area with hard waste including asbestos-containing materials that was cleaned up at the abovementioned four sites alone was approximately 387,000 square metres.

Business Case

The presence of ACMs at APY landfills represented a risk to the community and reflected historically poor planning and building practices. Addressing these risks was essential in protecting the community and ensuring that former landfill sites were remediated to a point where the chance of exposure was minimised.

It was not considered feasible, practical or cost effective to transport and dispose of all ACM off-site. A recommendation was made to implement on-site management strategies for identified ACM at each landfill; adopting a precautionary approach across all of the landfill sites, minimising disturbance and access to the landfill sites, collecting and cleaning up all hard waste at each site and burying or mounding the waste prior to capping.

Management of risks

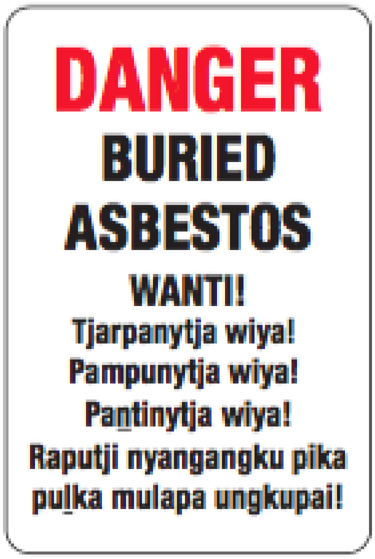
Development of new landfill sites as part of the decommissioning of the asbestos contaminated landfills required the management of stakeholder risks. This included community consultation with Traditional Owners and local committees, obtaining development approvals from SA's Development Assessment Council and obtaining approvals for Heritage Impact Assessments from the APY Anthropology Team.

Innovation and excellence

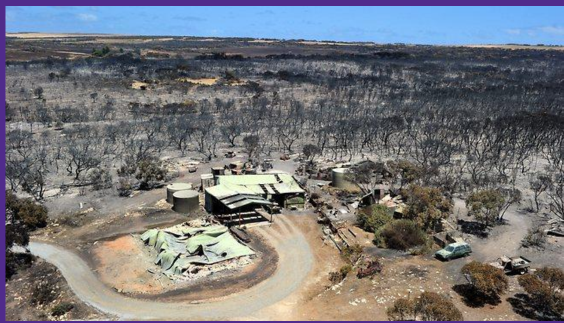
One of the key areas of excellence in this project was the communication methods used with the local Indigenous communities. The project team needed to focus on providing information without causing unnecessary alarm and in a culturally sensitive manner. They also recognised the need for ongoing messaging and communication to ensure residents understood the process being undertaken. With this in mind, repeated discussions were held on the risk of asbestos throughout the project.

Messages were made in an environmental health context as well as a cultural context. The messages were delivered in language that was provided by Anangu.

Figure 5.7 – Examples of warning signs placed at the landfill sites in language



Sleaford Mere Fire Asbestos Removal



Case Study 6 – Sleaford Mere Fire[8]

Project overview

The Sleaford Mere fire was a devastating bushfire that swept across the Lower Eyre Peninsula in November 2012. In the aftermath of the fire, the community concerns over burnt asbestos debris at a large site in the region were brought to the attention of Council. Although the site was privately-owned, Council decided to exercise its 'duty of care' to ensure the removal of over 200 tonnes of asbestos debris and contaminated soil. Council ensured the removal process was efficient and safe, and in agreement with the landowner the cost of the works was paid for by Council and treated as a 'charge against the land' on the property owners rate file. To minimise costs, the landfill levy was waived, and the local landfill took higher volumes of asbestos containing material and soil than it would usually accept. A summary of the project is presented in Table 6.1.

Table 6.1: Key information from the asbestos debris and contaminated soil case study

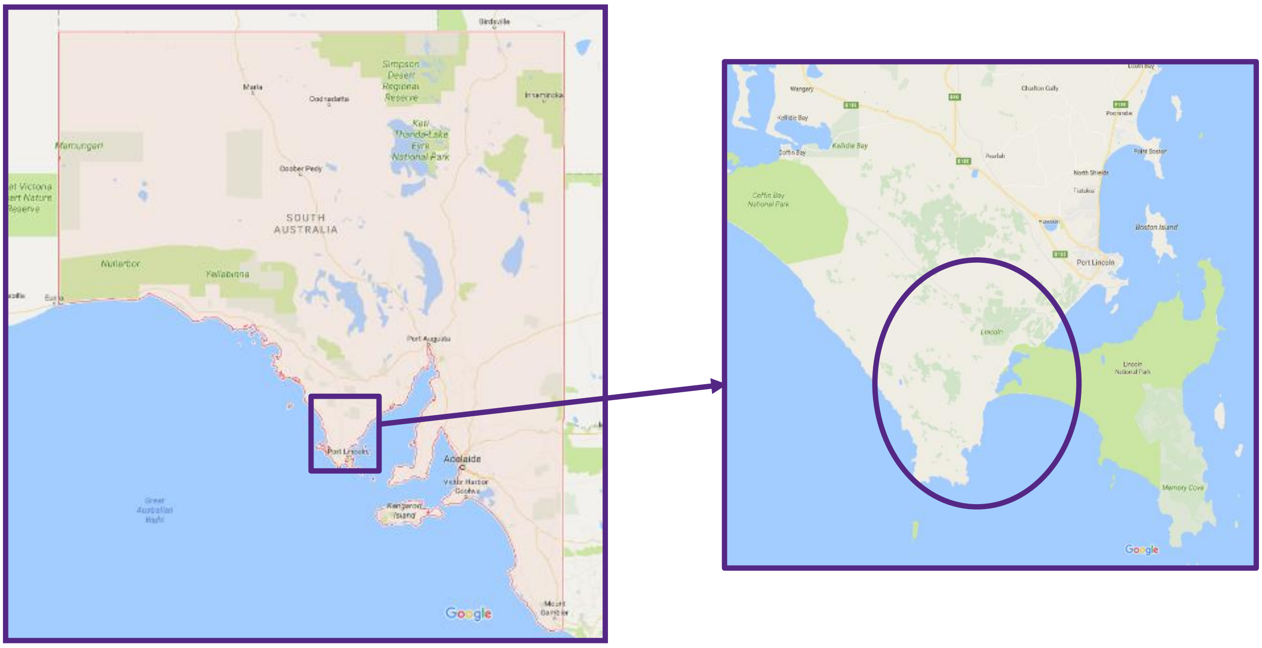
Key information	Finding
Location	Lower Eyre Peninsula, Rural South Australia
Removal period	January 2013
Volume of asbestos	Approx. 230 tonnes of non-friable asbestos soil and other debris
Cost to remove	Approx. $110,000, government funded charge on the land
Distance from licensed landfill used for disposal	Taken to landfill in Port Lincoln, less than 50 kilometres from the site
Key considerations for the asbestos clean-up	• Asbestos materials on private land. • Community concern over airborne asbestos. • To ensure efficient and proper clean up, Council paid for the asbestos removal but negotiated re-payment through charge of the land.

[8] Right image above demonstrates the impact of the fire. Image sourced from Adelaide Now, taken by Mark Brake on the Seven News Helicopter, accessed here

Background

The Sleaford Mere Fire (or Tulka Fire) was a devastating bush fire that swept through a large section of the lower Eyre Peninsula, rural South Australia, in November 2012 (see Figure 6.1). It covered 1800 hectares and resulted in extensive stock losses and damages to homes and other buildings[9].

Figure 6.1: Location in South Australia (left image), approximate area where the Sleaford Mere fire took place (circle in right image)[10]



Bush fires and other natural disasters often lead to the destruction of buildings that contain asbestos materials. This can present a potential hazard to the community, as bonded asbestos breaks up to become airborne asbestos fibres.

After the Sleaford Mere fire, the community raised concerns with the District Council of Lower Eyre Peninsula (Council) over potential burnt asbestos debris on a local site. Potential asbestos containing materials (ACMs) in burnt buildings and sheds were now spread across the site and mixed with the soil. The site was a deceased estate and the Executor of the estate lived interstate. Although the land was privately owned, it was situated near public areas, and there was a reasonable risk that members of the public would access the site.

[9] See http://www.adelaidenow.com.au/news/south-australia/tulka-fires-on-sas-lower-eyre-peninsula-point-to-worst-fire-season-in-decade-cfs-warns/news-story/68d89c8923fd75870300bdb7ce576e21

[10] Map data: Google

Site sampling, assessment and project planning

Sampling

The Council conducted sampling at the site, which included an assessment of the debris and soil, which confirmed the presence of non-friable asbestos in the debris and soil. Air monitoring was also undertaken with results being below the WorkSafe Australia exposure threshold. The independent air monitoring and asbestos sampling agency recommended full decontamination be undertaken as the site posed a high risk for persons on and in close vicinity. The asbestos identified at the site is captured in Table 6.2 below.

Table 6.2: Asbestos identified at the site

Asbestos Type	Quantity	Locations
Non-friable asbestos cement sheeting in burnt debris and soil	Approx. 230 tonnes	In the Sleaford area, rural South Australia (exact location anonymised for the case study)

Liability for asbestos removal

As the property was privately owned and the Executor could not fund the asbestos removal, Council had to decide whether it would remove the asbestos containing materials. After liaising with SAPOL and the EPA SA, Council decided to exercise its 'Duty of Care' to the public by issuing an Emergency Order under the Development Act, which stipulated that contaminated material including asbestos must be removed from the land. The owner of the land provided permission for Council to arrange clean-up of the site, and under the terms of the order issued, Council had the power to undertake the required works and charge the cost against the land. Council decided to waive any interest on the charge for a period of up to 12 months, which was in line with support provided by the Council to residents following a fire in 2005.

Asbestos removal program

Removal program

Council sought quotes from two asbestos removal companies. All burnt materials were removed and treated as asbestos contaminated. The works were carried out in January 2013 over five days and included:

- Removal and disposal of all asbestos cement material situated on site including above ground (see Figure 6.2) and in the top layer of the soil;
- Air monitoring on site whilst removal work was in progress;
- Removal of fire damaged sheds, containing asbestos cement material;
- Transportation of all asbestos material to be carried off site by an EPA approved contractor with licenced vehicles (this was transported to the Port Lincoln landfill);
- Site tidy up upon completion.

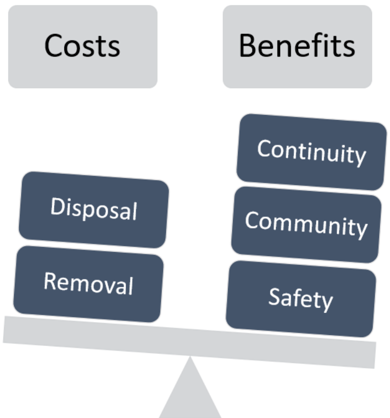
Figure 6.2: Removal of asbestos containing materials

Communication with stakeholders

After residents raised concerns of potential asbestos contamination at the fire affected site, Council responded proactively. Council sought advice from the EPA and SAPOL, and were quick to have the site assessed for asbestos, including airborne asbestos. Although this indicated the presence of asbestos and the recommendation for its removal, it was identified that the asbestos was not airborne or friable. As such, the community was safe at the time and this could be communicated with concerned residents.

Key consideration for future projects
Communication with the EPA, SAPOL and SA Health was critical for the success of this project, including for minimising costs to Council.

Business case



Significant community concern in relation to the contaminated site meant Council needed to act quickly to address the issue. Analysis of potential funding options, given the site was a privately owned deceased estate, was essential in developing a business case for removal works. The land was valued at an estimated $200,000 (based on successful remediation) and this was factored against estimated removal costs of around $110,000. The Council moved quickly to enact the existing legislative clause in order to remediate the site and recover costs either by the land owner making payment to Council (through rates) or upon sale of the property. It was also recognised that Council could sell the property if rates remained unpaid for a period of 3 years or more. This method ensured Council could conduct the work for public safety and future site safety, but be confident of being reimbursed for all costs.

Council made every effort to minimise costs while ensuring the work was completed to a high standard. The SA EPA agreed to waive the solid waste levy for the disposal of the asbestos contaminated debris and soil, and the waste was disposed for general waste costs (approx. $110 per tonne). This allowed the material to be disposed of locally, rather than being transported to Adelaide (over 600 kilometres away). This required planning and stakeholder negotiation as the local landfill would usually only accept 100 tonnes per year of non-friable asbestos. These negotiations were critical in the success of the project as the additional transport and disposal costs could not have been offset against the estimated land value of $200,000. Given the close proximity of the landfill, the removal was able to be undertaken over five days.

Key consideration for future projects
Costs were minimised through waiving the landfill levy, and transporting the waste to a local landfill less than 50 kilometres away. This was critical in developing a sound business case for the removal of asbestos containing debris and soil.

Management of risks and use of regulations

Identified risks and relevant regulations, and the implemented mitigation strategies are provided in the table below.

Table 6.3: Risks and mitigation strategies

Identified risk/ regulation	Mitigation strategy
If the asbestos was not managed at the site, later works or weather could disrupt the bonded asbestos on and within the soil, creating friable, airborne asbestos that could be breathed in by the community	Council decided to coordinate the removal of asbestos. This ensured a licensed removalist conducted the removal properly and efficiently.
As Council was arranging the clean-up rather than conducting the removal, Council had to ensure contractors were not putting themselves or others at risk	A contractor management and job safety analysis was undertaken prior to engaging the asbestos removal contractor. This identified the hazards at the site (including underground services, asbestos, soil contamination etc), and required controls (appropriate PPE). Contractors were also taken through a site induction prior to commencing.
Community concern over asbestos becoming airborne before, during or after the removal process	Asbestos testing and air monitoring at the site was conducted soon after the disaster, in mid to late November. The fact that the testing was being conducted was communicated to residents who enquired about the situation regarding the site. During the asbestos removal, constant air monitoring was undertaken, and after the asbestos was removed, the site was properly cleaned and left tidy.
Development Act requires that the site must be made safe	When exercising its ‘Duty of Care’ to the public, Council issued an Emergency Order that referred to the Development Act and outlined that there was a requirement for the site to be made safe. In this case making the site safe involved the removal of burnt material and debris, including material contaminated by asbestos.

Figure 6.3: Asbestos contaminated materials being loaded into a truck

Innovation and excellence

This asbestos removal program, albeit small, showed significant innovation and excellence in planning and execution. Council's decision to work with the Executor of the estate and to use its power to take responsibility for the clean-up based on protecting the community was essential in addressing community concerns. In addition, Council was able to:

- Minimise costs through:
  - waiving the landfill levy,
  - negotiating the acceptance of more than the maximum amount of asbestos at the closest landfill
- Pay for the removal themselves to ensure a more efficient and safe removal process was undertaken;
- Generate two potential reimbursement methods:
  - Recording costs incurred as a charge against the land, noting that this could lead to sale of the land for non-payment of Council rates in three years if the debt remained unpaid.
  - The landowner paying Council back over time.

Figure 6.4: the fire near Tulka (top left image) and shacks and homes destroyed by the bushfire at Sleaford Bay[11]

[11] Images sourced from Adelaide Now, taken by Mark Brake on the Seven News Helicopter. See http://www.adelaidenow.com.au/news/south-australia/tulka-fires-on-sas-lower-eyre-peninsula-point-to-worst-fire-season-in-decade-cfs-warns/news-story/68d89c8923fd75870300bdb7ce576e21

Asbestos remediation in Clayton, Vic

Case Study 7 – Asbestos Remediation in Clayton, Vic

Project overview

A manufacturing and engineering company (the company) discovered asbestos contaminated soil during a site reconfiguration in Clayton, Victoria. Initially believed to have minor contamination, over 11,000 tonnes of asbestos contaminated soil were eventually removed. Multiple removal methods were trialled to assess cost, efficiency and safety. Despite lower cost options being identified, it was ultimately decided that full removal of the asbestos contaminated fill material would deliver the best long-term outcome, both in terms of improved site safety and eventual reuse of the site in the future.

Communication with staff throughout the process was key to reducing their concerns and ensuring smooth delivery. The remediation process was highly successful, with no positive airborne asbestos readings, minimal complaints from staff and the efficient removal of high volumes of asbestos contaminated soil.

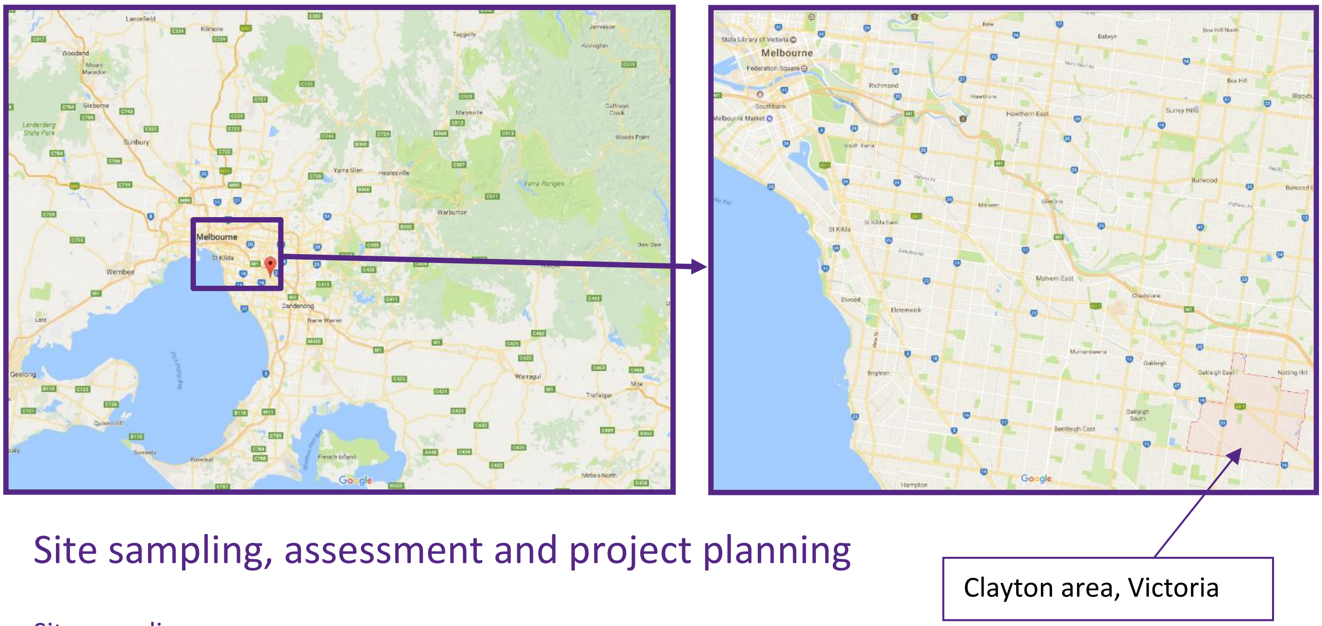
Table 7.1: Key information from the asbestos contaminated soil case study

Key information	Finding
Location	Clayton, Victoria
Removal period	January 2017 – March 2017
Volume of asbestos	Over 11,000 tonnes of ACM (contaminate soil) to date
Cost to remove	Cost not provided. Work was privately funded.
Distance from licensed landfill used for disposal	Approx. 50 kilometres
Key considerations for the asbestos clean-up	• Unexpectedly large volumes of asbestos contaminated soil discovered part way through a project; • Multiple methods of removal trialled for safety, efficiency and cost; • Works carried out close to staff and as such, communication was critical.

Background

In 2016, the company began reconfiguring its site in Clayton, Victoria (see Figure 7.1), including some required building demolition and the construction of a new car park. The infrastructure on the site was first built in the 1950s and was known to contain asbestos. In addition, there had been previous demolitions at the site and it was suspected that asbestos containing materials had been buried.

Figure 7.1: Location of Clayton in relation to Melbourne, Victoria[12]



Site sampling, assessment and project planning

Site sampling

Prior to commencing building demolition and ground levelling for the car park, an independent environmental contractor conducted drilling through slabs in the ground. Despite the results not revealing any asbestos contamination in the tested areas, the company was aware of asbestos at the site. As such, demolition and levelling works commenced at the site with the expectation that asbestos would be found, albeit an unknown volume and location. The company ensured that there was some flexibility in the budget and timelines to manage asbestos contamination as it arose.

Identification of asbestos after project commencement

In October 2016, after commencing the demolition and levelling works for the car park, asbestos was found in the soil. Further investigation revealed extensive asbestos contamination in the soil in both surface soil and at deeper levels. Construction was stopped, and further sampling was undertaken in November 2016. Testing by Prensa, the asbestos testing and advisory firm, found that a significant proportion of the proposed car park construction area was contaminated, with ACM present at varying depths from 0 m to 1.9 m. The asbestos contamination had been introduced via fill material brought in during the 1960s to level the site in preparation for construction of new buildings. That fill material would have been considered clean fill at the time.

[12] Map data: Google

Asbestos removal program

Overview of removal program

The company considered four methods for removal. For cost, safety and efficiency reasons, and to ensure the site was properly remediated for future developments, contaminated fill across the entire impacted area was excavated. The contractors removed over 11,000 tonnes of asbestos contaminated soil (see Table 7.2), which was safely transported to an appropriately licenced site approximately 50 kilometres away.

Table 7.2: Asbestos identified at the site

Asbestos Type	Quantity	Locations
Bonded asbestos sheeting and other asbestos contaminated building parts	Over 11,000 tonnes of asbestos contaminated soil	Across the entire area, from 0m to 1.9m underground

Site plans

The site plans presented in Figure 7.2 below show the extent of asbestos contamination in the soil fill area which was removed from depths between 0m and 1.9m.

Figure 7.2: A section of the company's site, with ACM contaminated soil fill area located within the purple square

Consideration of removal methodology

Upon discovery of the asbestos, the company investigated different removal methodologies and considered cost, safety and efficiency. Consideration was given to existing guidelines for dealing with contaminated sites provided by the global parent company and a trial period for different methodologies was completed in January 2017 with advice provided by Prensa. Options included:

1. Picking out each individual piece of asbestos as it is discovered. This was found to be time consuming and laborious.
2. Sieving the asbestos. This was very inefficient and presented dust problems for individuals nearby, and there was no guarantee that all asbestos would be removed.
3. Dig up an area to a certain level across the impacted area, and inserting a geo fab with crushed rock above, to protect the asbestos below the surface. This would present potential asbestos issues for future works at the site.
4. Remediate the entire impacted area down to the natural soil depth. This was the most expensive option but guaranteed the site was ‘future proofed’ from further asbestos issues, and it was deemed that removal works could be carried out reasonably efficiently.

The company determined that the fourth option was the most appropriate.

Removal of the asbestos contaminated soil

Asbestos containing soil was excavated over a 2-month period and safely transported to an appropriately licenced landfill approximately 50 kilometres away using licensed carriers. Prensa conducted daily monitoring of potential airborne asbestos and this was checked by the company, and communicated with their staff who were working nearby. The asbestos contaminated soil was kept moist throughout the process to minimise the likelihood of airborne asbestos (see Figure 7.3). Figure 7.4 includes examples of ACM in soil at the site.

Figure 7.3: Asbestos removalist keeping the asbestos contaminated soil moist

Figure 7.4: Asbestos contaminated soil found during the project (right image has asbestos circled in blue)

Communication with stakeholders

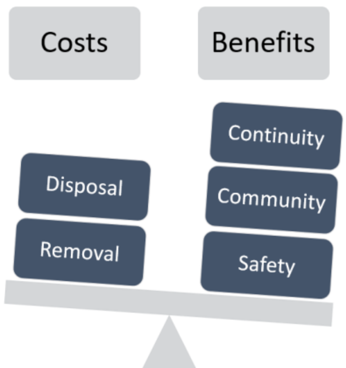
The site of asbestos contamination was close to operational buildings where company employees worked. Communication was critical to ensure staff were kept informed on what was happening, knew about safe access areas and that they were safe from airborne asbestos while at work.

The Health and Safety Manager provided staff with monthly updates on air monitoring readings as well as information about where the project was up to. Information was also provided via notice boards and intranet notifications. Health and Safety Representatives were specifically briefed and involved in answering staff questions. The Health and Safety Manager also contacted external companies that frequently accessed the site and provided an overview of what was happening and appropriate access pathways.

"Providing the air monitoring results to staff was critical in keeping fear levels down and providing confidence of safety while at work."

Health and Safety Manager, manufacturing and engineering company

Business case



The company was expecting to find asbestos contamination at the site prior to commencing the project. As such, they had allocated some budget and time for this. However, the extent of the asbestos contamination was much larger than originally anticipated.

When asbestos was discovered, the company considered multiple options for its removal. It was decided that a full remediation of the ACM soil fill was appropriate, rather than covering up the ACM, picking the pieces out or sieving the asbestos. Although this was not the lowest cost option, it was a more efficient process and would ensure no future asbestos issues at the site. This was particularly important as the company owned the land and could conduct future works. The company therefore viewed this as lower cost in the long term, as future asbestos management expenses were expected to be higher.

Key lessons learnt

Key lessons learnt through the planning and delivery of this project included:

1. The importance of extensively testing incoming fill material to ensure there is no contamination. Removing the asbestos contaminated soil through site remediation after installation is more expensive and time consuming than identifying contamination upon the arrival of materials/ soils. The company is now more rigorous in its testing of incoming material, undertaking inspections, checking associated reports in detail, requesting further details (such as photos and dimensions), matching up volumes, commissioning additional testing if deemed appropriate and so forth.
2. Ensure clear and effective communication is undertaken with key stakeholders. The project showed that open and transparent communication is critical, including the provision of air monitoring results which ultimately were an effective tool in reducing staff concerns during the removal project.

Figure 7.5: Pictures of the remediation program (top) and evidence of asbestos in soils (lower)