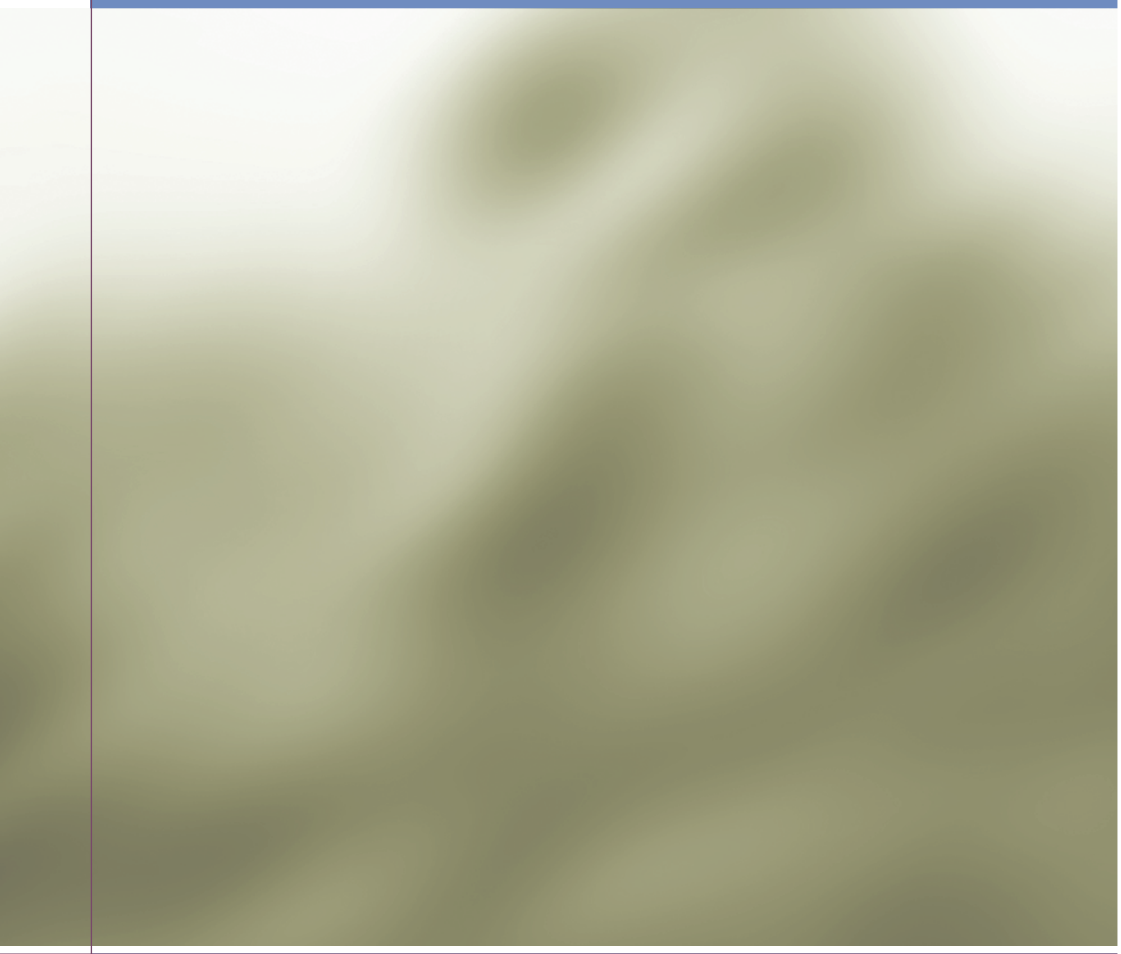
ASBESTOS MANAGEMENT AND CONTROL: A REVIEW OF NATIONAL AND INTERNATIONAL LITERATURE



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Glossary

ACM: Asbestos-containing material

Asbestos: the fibrous form of mineral silicates belonging to the serpentine and amphibole groups of rock-forming material, including actinolite, amotise (brown asbestos), anthophyllite, chrysotile (white asbestos), crocidolite (blue asbestos), tremolite, or any mixture containing one or more of the mineral silicates belonging to the serpentine and amphibole groups.

ASCC: Australian Safety and Compensation Council

Bonded asbestos: means ACM, where the asbestos fibres are held within a matrix of other material, such as cement.

Friable asbestos: means ACM which, when dry, is or may become crumbled, pulverised or reduced to powder by hand pressure.

In situ: means fixed or installed in its original position, not having been moved.

NOHSC: National Occupational Health and Safety Commission

Objective

In 2007, the Australian Safety and Compensation Council (ASCC) agreed to prepare a series of literature reviews with the objective of examining:

- studies on the weathering and corrosion of, and resulting release of, airborne fibres from different forms and uses of asbestos
- information on current work practices and exposures which may be occurring in Australian and overseas workplaces, and
- policies and practices adopted overseas regarding the management of in situ asbestos and/or its removal.

A report entitled A literature review of Australian and overseas studies on the release of airborne asbestos fibres from building materials as a result of weathering and/or corrosion (ASCC, 2008, published on the ASCC website: www.ascc.gov.au) covered the first of the above dot points. The current review examines the remaining two dot points.

Background

History of asbestos production and use

Asbestos is the fibrous form of mineral silicates belonging to the serpentine and amphibole groups of rock-forming material. It includes actinolite, amosite (brown asbestos), anthophyllite, chrysotile (white asbestos), crocidolite (blue asbestos), tremolite, or any mixture containing one or more of the mineral silicates belonging to the serpentine and amphibole groups.

Exposure to airborne asbestos fibres can lead to a number diseases, including asbestosis, mesothelioma and lung cancer. It is unclear what level of exposure causes the development of these diseases, and there is typically a long latency period between the relevant exposure and the onset of the disease. Due to the long latency associated with these diseases it is expected that their incidence in the Australian population will not peak for some time, despite the fact that asbestos is now a banned substance and in-situ asbestos is subject to strict management procedures.

In Australia, more chrysotile than amphibole asbestos was mined until 1939. New South Wales, the first State to mine asbestos, produced the largest tonnages of chrysotile (until 1983) as well as smaller quantities of amphibole (until 1949). With the commencement of mining in Wittenoom, Western Australia in 1937, crocidolite dominated production until final closure of the mine in 1966. In addition to what was mined, Australia also imported chrysotile from Canada and crocidolite and amosite from South Africa. Consumption peaked in about 1975 at 70 000 tonnes per year (Leigh et al. 2002).

Australia also imported many manufactured asbestos-containing products, including cement articles, yarn, cord and fabric, joint and millboard, friction materials and gaskets. The main sources of supply were the United Kingdom, US, Federal Republic of Germany and Japan. With the closing of the crocidolite mine

at Wittenoom, Australian asbestos production and exports declined. Imports of chrysotile also started to decline (Leigh et al. 2002).

In Australia, over 60% of all production and 90% of all consumption of asbestos fibre occurred in the asbestos cement manufacturing industry. (Hughes, 1978 in Leigh et. al. 2002). From about 1940 to the late 1960s amosite, crocidolite and chrysotile were all used in this industry. Crocidolite was phased out from 1967, amosite was used until the mid 1980s and chrysotile until about 1987. Much of the industry output remains in service today in the form of “fibro” houses and water and sewerage piping. By 1954 Australia had the fourth highest consumption of asbestos cement products in the western world, after the US, UK and France, and the first on a per capita basis. (Leigh et. al. 2002) After World War II to 1954, 70 000 asbestos cement houses were built in the state of NSW alone (52% of all houses built). In Australia as a whole, until the 1960s, 25% of all new housing was clad in asbestos cement [NOHSC:2018(2005)].

Reports of asbestos use internationally go back as far as 2500 BC when it is believed that asbestos was used to make pottery (Lemen & Bingham, 1994). Modern uses of asbestos began in the mid 1800s when it was used as a packing material, the use of asbestos-containing materials (ACMs) was progressively expanded up until the middle of the twentieth century (Vitra, 2006). Through most of the 19th century, Canada dominated the production and export of asbestos products, however during the 20th century, the US was the largest market economy and world user of asbestos (Vitra, 2006). The Soviet Union (later Russia) became the largest consumer of asbestos products in 1970, and the largest producer from 1975. Several other countries (including Canada, China and Brazil) continue to mine asbestos despite the known health risks associated with its use (Vitra, 2006).

In 1996 the World Health Organisation (WHO) agreed to work with other intergovernmental organisations in order to eliminate asbestos related diseases. Part of this strategy involves the effective management and control of asbestos. While production and consumption of asbestos products continues in several countries, a number of countries have adopted bans on the importation and use of asbestos products. With a few technical exemptions, bans have been adopted in over 40 countries, including Australia and all member states of the European Union (ACT Asbestos Task Force, 2005). Less stringent regulations have been adopted in other countries. There have also been calls for an international ban on asbestos to be introduced and enforced (BWI & IBAS, 2006).

Regulation of asbestos in Australia

Exposures to asbestos in the past were very high in some Australian industries and occupations. For example, there has been as much as 25 million particles per cubic foot (150fibres/ml) in asbestos pulverisors and disintegrators in the asbestos cement industry (Roberts and Whaite, 1952 quoted in Leigh et. al. 2002), and up to 600 fibres/ml in baggers at Wittenoom (Major, 1968 in Leigh et.al. 2002). However, the recognition of the associated health risks led to a series of regulations being adopted nationally in the late 1970s. Exposure limits of 0.1 fibres/ml for crocidolite and amosite; and 1.0 fibres/ml for chrysotile were imposed. In July 2003 a revised national exposure standard for chrysotile asbestos of 0.1 fibres/ml was declared by the National Occupational Health and Safety Commission (NOHSC).

In 2001 NOHSC declared a prohibition on all uses of chrysotile asbestos from 31 December 2003, subject to a very limited range of exemptions, and confirmed earlier prohibitions of the use of amosite and crocidolite asbestos. The prohibition of chrysotile was adopted simultaneously under regulations in each Australian OHS jurisdiction, as well as Australian Customs, on 31 December 2003. The prohibition does not extend to ACMs in situ at the time prohibition took effect and is subject to a very limited range of exemptions.

Since 1988, NOHSC and then the ASCC, has provided detailed guidance material to minimise occupational exposures to asbestos. This material was revised in 2005 and includes national codes of practice for the safe removal of asbestos and for the management and control of asbestos in workplaces ([NOHSC:2018(2005)] and [NOHSC:2002(2005)]). It also includes a Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres 2nd Edition [NOHSC:3003(2005)].

Australia, the US, the European Union and the UK have had policies and standards for asbestos management in place since the 1980s, or earlier, and are the most advanced in their management processes (ACT Asbestos Task Force, 2005). The Occupational Safety and Health Administration (OSHA) in the US has regulated exposure to asbestos since 1971 and has modified its standards several times since in response to new information about asbestos and the associated risks becoming available (Martonik et al., 2001). All of these countries restrict who is able to undertake work with asbestos materials and have strict training requirements in place.

As a result of its high level of asbestos consumption in the past, Australia has a legacy of a large volume of in situ asbestos in the form of ACMs in buildings (especially domestic buildings), and in water and sewerage piping. Disturbing in situ asbestos can result in the release of airborne asbestos fibres. As a result, state and territory legislation prohibits many activities involving in situ asbestos, such as drilling, boring and grinding. Removal of in situ asbestos and the renovation/demolition of buildings containing these materials is also known to increase the risks of asbestos exposure unless undertaken in accordance with the regulations. Information and training must be provided to workers, contractors and others who may come into contact with ACM in their workplaces [NOHSC:2018(2005)].

Literature on current work practices and exposures to asbestos

The focus of this review is current work practices in Australia or other countries that have similar regulations and prohibitions in place. A literature search was conducted on OSHROM (including Medline, HSEline, CISDoc, RILOSH and NIOSHTIC) and Current Contents. The following search terms were used:

> Asbestos and (exposure or control* or compli* or comply or practice* or maintenance or plumber* or electrician* or behaviour* or attitude* or remov* or building*)

Articles dealing with current work practices in countries where asbestos is still mined or where ACMs are still manufactured or used were not reviewed. The search was further narrowed to retrieve only articles published since 1999. In

addition relevant web sites were searched such as the UK Health and Safety Executive, the US National Institute for Occupational Safety and Health and Australian web sites.

While the search retrieved a wealth of information regarding past exposures to asbestos of people diagnosed with asbestos related disease, the search resulted in only five studies or reports on current work practices and exposures being located. There were only two Australian reports identified. The first was a report produced as part of the Heads of Workplace Safety Authorities national campaign on *Demolition and Asbestos Removal in the Construction Industry* (HWSA 2007)*;* the second was a report prepared by the ACT Asbestos Task Force discussing the results of focus groups run in the ACT (ACT Asbestos Task Force 2005b). The findings of each of these studies indicate that, despite regulations and guidance materials being in place, it is likely that exposure to asbestos continues to occur in some circumstances.

Demolition and Asbestos Removal in the Construction Industry (HWSA 2007)

The Heads of Workplace Safety Authorities conducted a national campaign in 2006 which focused on the safety of demolition work, and any associated asbestos removal. The results of this campaign were published in 2007 (HWSA 2007). The campaign aimed to improve the levels of compliance associated with demolition and asbestos removal; improve the capability of contractors to recognise, manage and control demolition and asbestos related hazards; increase perceptions of the risks of detection and sanctions imposed where non-compliance is identified; and to promote best practice and good innovations being used throughout Australia. Of the 376 site visits completed nationally, asbestos removal was being undertaken in 292 sites as part of the demolition. Results of these visits indicated that only 214 of these sites were compliant in their asbestos removal. Of the 15 issues targeted during the campaign, the lowest level of compliance (73.3 per cent) related to asbestos removal.

As part of the campaign, various enforcement activities were undertaken, including the issuing of improvement, prohibition, infringement and compliance notices. South Australia was the only state in which 100% compliance was observed, and the report suggests that this may be due to the strict legislative requirements that must be met in this state prior to asbestos removal (HWSA, 2007, p. 17).

Exposure of UK Industrial Plumbers to Asbestos.

The UK Health and Safety Laboratory conducted a study prior to the introduction of the new duty to manage asbestos in non-domestic premises came into force in the UK in 2004. The aim of the study was to assess whether industrial plumbers were knowingly or unknowingly exposed to asbestos and obtain a detailed picture of workers' awareness, assumptions and responses to working with ACMs. One hundred plumbers were provided with passive samplers, a work log and a questionnaire.

The results were published in two articles, the first of which dealt with the asbestos exposure of the plumbers measured with personal passive samplers over the course of a working week. Of the 50 workers sampled in part 1 of the study, assessment of the passive samplers found that 62% had been exposed to asbestos during the week. Of these workers, 24 were re-sampled and results

indicated that 58% had been exposed to asbestos during the second period of sampling (Burdett & Bard, 2007). Interestingly, the samples with the highest levels of asbestos occurred in plumbers working in areas which had apparently been stripped of asbestos prior to them commencing work (Burdett & Bard, 2007).

The work logs indicated that although the plumbers were all listed as industrial plumbers 72% of the jobs were carried out in domestic premises. Results of the survey and work log indicated that there was a high correlation between those plumbers who were knowingly working with asbestos, and the detection of asbestos fibres via their passive samplers. That is, for 84% of those who indicated that they suspected or knew that they were working with asbestos over the two rounds, the passive samplers detected asbestos fibres.

However, several of the plumbers were unaware that they were working with asbestos despite fibres being detected via their passive samplers. The results suggested that plumbers were aware of only a third of their contact with asbestos materials during the working week (Bard & Burdett, 2007). In fact, the asbestos exposure of workers who thought they were not working with asbestos was generally higher than those who were knowingly working with asbestos, presumably because those plumbers that were unaware of this contact were not applying any control measures (Bard & Burdett, 2007).

Swedish construction workers

Engholm and Englund (2005) undertook a cohort study on workers in the construction industry in Sweden where a total ban on asbestos use was enforced in 1982 and the use of ACMs in the construction industry ceased in 1976. They found that while there were indications that the incidence of pleural mesothelioma among men was slowly starting to decline, the incidence among construction workers was not declining. In some job categories the incidence appeared to be increasing. These categories (electricians, floor layers and possibly painters) shared the feature of having been exposed during repair or maintenance of existing ACMs in buildings.

Tradespeople in the Australian Capital Territory

A study by the ACT Asbestos Task Force in June 2005 involved conducting a focus group with ACT tradespeople in order to investigate their behaviour and concerns regarding asbestos (ACT Asbestos Task Force, 2005b) in the workplace. Whilst most of the tradespeople interviewed were aware of the dangers involved in handling in situ asbestos, some admitted to proceeding with work recklessly, as following the appropriate guidelines would delay the job or add to their costs. The Task Force suggested that further information needed to be provided to tradespeople regarding the health risks of asbestos exposure, the OHS implications of failing to appropriately manage the issues, and the legal and career damaging side effects associated with improper handling of asbestos.

Survey of construction and building maintenance workers in the UK

A study similar to that undertaken by the ACT Asbestos Task Force was conducted on behalf of the HSE in the UK. Sixty individuals working in construction and/or maintenance were interviewed in order to examine barriers to behaviour change when working with asbestos (HSE, 2007). The study found

that attitudes towards working safely with asbestos were mostly affected by whether or not the perceived negative impacts of complying with the guidelines (i.e. economic, social and time costs) outweighed the perceived positive benefits.

The report identified four key areas which influenced how likely it is that an individual will behave safely around asbestos. The first issue relates to the complexity of the messages disseminated about asbestos, its health effects, how to identify it and how to handle it effectively. The second related to psychological issues, notably the individual's attitude towards risks in general, their own and others' health and the specific risks associated with asbestos. Cultural factors were the third identified key area. That is, pressures from an individual's employers, clients and co-workers have a large impact on how they will deal with asbestos, and these pressures are driven largely by economic and social factors. The final issue identified was the extent to which the individual feels they are able to control their environment.

Summary

These studies indicate that despite the presence of regulations and guidelines on the safe handling and removal of asbestos, both nationally and internationally, there is a risk that some workers continue to be exposed to airborne asbestos fibres due to a lack of awareness of the appropriate methods required to detect, manage, remove and dispose of asbestos and possible non-compliance with existing regulations.

Management and/or removal of in situ asbestos: policies and practices adopted overseas

Many countries continue to export, import and use asbestos. In those countries where the risks have been acknowledged and steps have been taken to control or ban the use of asbestos, advice on whether or not to remove asbestos versus maintaining it in situ is available to varying degrees. This section examines policies, guidelines and research on the management and/or removal of asbestos in buildings.

The Australian *National Code of Practice for the Management and Control of Asbestos in Workplaces* [NOHSC:2018(2005)] states that in situ ACM must be appropriately managed to ensure that the risks of exposure to airborne asbestos fibres are minimised. The main elements of managing the risks of ACM in workplaces include identifying all ACM in the workplace, assessing the risks associated with ACM and putting in place control measures to ensure that exposure to airborne asbestos fibres is prevented.

Ultimately, asbestos free workplaces are desirable so wherever practicable, consideration should be given to the removal of ACM during renovation, refurbishment, and maintenance rather than other control measures such as enclosure, encapsulation and sealing ([NOHSC:2018(2005)]). However, the removal of ACM poses significant additional hazards to those risks associated with maintaining asbestos in situ. In fact, "the removal of ACM can potentially expose workers and others to higher levels of airborne asbestos fibres than leaving the materials in situ" ([NOHSC:2002(2005)] p.xii).

URS Australia Pty Ltd was engaged by the ACT Asbestos taskforce to conduct a risk assessment of asbestos surveys completed of residential and public commercial buildings within the ACT. They concluded that:

> The systematic removal of all MCA[1] in buildings could be considered a risk mitigation measure that would address the potential for exposure to fibres when undertaking intrusive works. However, the widespread removal of MCA in itself may result in elevated concentrations of asbestos fibres within buildings that may persist for a number of weeks following the asbestos removal. Concentrations may reduce with time to values the same as before the asbestos was removed. Thus for the occupants the net result is no change in risk. The lowest risk activity would therefore be to leave stable MCA in place and use risk mitigation measures when intrusive works are required. Removal of MCA from buildings may therefore best be undertaken on an opportunistic basis rather than a programme of systematic removal. (URS, 2005. p. ES-6)

A separate *National Code of Practice for the Safe Removal of Asbestos* [NOHSC:2002(2005)] has been developed which specifies in detail the procedures and precautions that must be taken when removing ACM. According to the general principles of an asbestos management plan [NOHSC:2018(2005)], once asbestos has been identified in a workplace, an assessment of the condition of the ACM must be conducted. If there is found to be no risk to health then the ACM is to be labelled, maintained and left undisturbed. Removal of the ACM may not always be the best option, and is only recommended if the ACM is found to pose a risk to health, or the building is to undergo renovation or refurbishment. In addition, all ACM must be disposed of correctly in accordance with state and territory law.

The large number of houses in Australia containing ACM has raised concerns of potential risks to the health of home renovators. The risk assessment undertaken by URS for the ACT Asbestos Taskforce concluded that:

> Activities that could result in exposures above background would be poorly controlled major intrusive works that have the potential to affect ambient air quality during the works and for a period following the works. These types of activities would occur infrequently and likely to be one off events in a particular house. If appropriate controls are put in place, then effects on ambient levels would be minimal. (URS, 2005. p. ES-4)

The health risk assessment conducted on behalf of the ACT Asbestos Task Force found that residents and occupants of houses and buildings containing ACMs are *not* likely to be exposed to more fibres over a lifetime than residents and occupants of buildings that do not contain ACMs (URS, 2005). It is likely that the situation in the ACT is similar to that in other areas of Australia in that ACMs in good condition in residential properties are unlikely to be a significant cause of asbestos exposure.

[1] Material containing asbestos

The broad consensus from the studies and reports reviewed in A literature review of Australian and overseas studies on the release of airborne asbestos fibres from building materials as a result of weathering and/or corrosion (ASCC, 2008) was that the release of airborne fibres from non-friable asbestos building materials as a result of aging, weathering and corrosion is exceedingly small. It was concluded that "in most circumstances high levels of asbestos fibre release from aging, weathering and/or corroding asbestos building materials does not appear to be a common event" (ASCC, 2008, p. 18).

During the 1980s and the early 1990s there was a heated public policy debate relating to the management or removal of asbestos in buildings and especially in schools in the US. Between 1979 and 1990 the US Environmental Protection Agency (EPA) produced seven guidance documents for asbestos containing materials in buildings (Wilson et al. 1994). Following publication in June1985 of the EPA's Guidance for Controlling Asbetos-Containing Materials in Buildings (also known as the Purple Book) and the passage of the Asbestos Hazard Emergency Response Act (AHERA) in 1986, there followed what some have described an "asbestos abatement frenzy."

> Clearly, the haphazard removal of asbestos-containing materials from buildings, work sites, schools and residences presents unacceptably high economic and health costs, while the alternatives to this strategy contain a number of important restraints. Nevertheless, a moratorium on the current asbestos abatement frenzy will do more for public health than will the continuance of thoughtless removal. (Esmen,1991, p.587)

In the late 1980s the US Congress charged the Health Effects Institute – Asbestos Research (HEI-AR) with undertaking a program of research:

- to determine actual airborne asbestos fibre levels prevalent in buildings;
- to characterise peak exposure levels and their significance; and
- to evaluate the effectiveness of asbestos management and abatement strategies in a scientifically meaningful manner.

As a first step a comprehensive literature review was undertaken by a panel of experts on the risks of exposure to asbestos in buildings (Health Effects Institute – Asbestos Research 1991). While HEI-AR acknowledged the lack of reliable data on many points, they made a number of generalisations.

- "Asbestos containing material (ACM) within buildings in good repair is unlikely to expose occupants to airborne asbestos fiber concentrations above the levels found in air outside such buildings…. there does not appear to be sufficient risk to the health of general occupants to justify arbitrarily removing intact ACM from well-maintained buildings.
- Janitorial, custodial, maintenance and renovation workers… may experience peak exposure episodes because of disturbance or damage to ACM …. the potential risk to exposed custodial and maintenance workers should be the primary determinant of any remedial action.
- Asbestos removal workers are at the highest risk of potential exposure. Good work practice and adequate respiratory protection are essential to

avoid dangerously high exposure of workers involved with removal of asbestos material.

- Determining the exposure risks in a given building and the forms of prevention are site-specific tasks….In well-maintained buildings with airborne levels of asbestos fibers similar to those found outside the buildings, removal or other abatement action, if done improperly, can cause increases of fiber levels that may persist for some time. On the other hand, in buildings where ACM has undergone continuing disturbance, appropriate abatement action may best reduce asbestos exposure of workers and other occupants." (Health Effects Institute – Asbestos Research 1991, pp. iii-iv)

In 1990 the US EPA updated its 1985 guidance in an effort to calm fears of building owners about the presence of asbestos in their buildings. The purpose of the document was partly to discourage the removal of all ACM regardless of its condition. (US EPA 1990)

The guidance states that removal is often not the best course of action to reduce asbestos exposure, particularly since improper removal can create more airborne asbestos fibres than were present when the ACM was in place. The guidance stated that the EPA only requires asbestos removal in order to prevent significant public exposure to airborne asbestos fibres during building demolition or renovation activities.

The EPA provides large amounts of guidance on active management strategies whenever ACM is discovered in a building. These guidelines are designed to protect occupants, as well as contractors and maintenance workers from potential asbestos exposure (Uhlig & Whitaker, 1991). It should be noted that maintaining asbestos in situ requires the commitment of sufficient resources from the owner/managers of the buildings affected (Hays, 1994).

The UK Health and Safety Executive advises against removing asbestos when it is in good condition and is unlikely to be damaged, disturbed or worked on, on the basis that removal can be more dangerous to health than maintaining the asbestos in place. (HSE, n.d.)

A number of studies have examined airborne asbestos in buildings prior to and following asbestos removal. A study published in 1988 by Jaffery et al., examined two buildings before, during and after asbestos removal and found that asbestos fibre levels inside the buildings studied increased after an asbestos removal operation. However, the amount of increase was largely dependant upon the methods used by the removalist and had this removal been undertaken according to the guidelines now in place it is likely that this increase in fibres would have been avoided.

Burdett et al. (1989, p. 289) reporting on surveys of airborne asbestos fibres in buildings collected by the UK Health and Safety Executive concluded that asbestos removal cannot be assumed to remove the risk to the occupants of a building and in most cases management of undamaged asbestos is preferable to removal.

The New Zealand Department of Labour has published detailed guidance on the maintenance of in situ asbestos and whether or not it should be removed (1999). This guidance is consistent with that provided in the UK, US and Australia.

Despite the fact that Canada continues to produce and export asbestos the Canadian Department of Health recommends that ACM in public buildings be monitored and that expert advice should be sought before any removal is attempted. Again, it is acknowledged that for asbestos to pose a health risk it must be in a friable state and therefore undamaged ACMs are not a significant risk to health (Health Canada, 2008).

Much of the legislation and guidance material regarding asbestos in Australia and overseas is directed towards the management and/or removal of in situ asbestos in the context of work.

With the large number of houses believed to contain ACMs in Australia it is important that 'do it yourself' (DIY) home renovators are aware of the risks of asbestos exposure and have access to relevant information. The Enhealth Council, with the Department of Health and Ageing, released comprehensive guidance material in 2005 on the *Management of asbestos in the non-occupational environment* (Enhealth & Department of Health and Ageing, 2005). This material covers the health risks associated with asbestos exposure in the non-occupational environment, as well as information on assessing and managing these risks. The ACT Asbestos task force has also identified this as an area for action and has released guidance material aimed at the home renovator. SafeWork SA has also released guidance material aimed at DIY builders, *Asbestos and the home mechanic* and *Asbestos and the home renovator.* Similarly, the Qld Department of Industrial Relations provides DIY builders with relevant information on its website.

No information was found to suggest that any countries currently recommend the systematic removal of all ACM over maintaining these materials in situ. There is general consensus that in situ asbestos should only be removed when it poses a significant risk to health (i.e. is in a friable state) or on an opportunistic basis (such as during renovation or demolition works).

Conclusion

A series of Australian regulations on asbestos have been adopted and date back as far as the late 1970s. Bans on the production and use of asbestos have been adopted in over 40 countries, including Australia. As a result, in those countries where regulations have been implemented and exposure limits are defined, there should be no significant exposure to asbestos if those regulations are complied with.

There has been very little research on the current work practices and potential exposures to asbestos in Australia or other countries with similar regulations and prohibitions in place. Only five relevant studies were located. All of these studies indicate that despite the presence of regulations and guidelines on the safe handling and removal of asbestos, both nationally and internationally, there is a risk that some workers continue to be exposed to airborne asbestos fibres due to a lack of awareness of the appropriate methods required to detect, manage, remove and dispose of asbestos and possible non-compliance with existing regulations.

Given the small number of studies on actual work practices in workplaces with in situ asbestos since the asbestos ban was implemented in Australia and the national codes of practices for safe management and removal of asbestos were

updated in 2005, it is recommended that research be conducted in Australian workplaces on current levels of compliance to regulations, barriers to compliance and any resulting exposure to asbestos.

In those countries where the risks to health from exposure to asbestos have been acknowledged and steps have been taken to control, or ban, the use of ACM, advice on whether or not to remove asbestos versus maintaining it in situ is available to varying degrees. Australia, the UK, the European Union, the US and NZ are the most advanced in their advice on in situ asbestos.

There is consensus amongst these countries that while the ultimate goal is for all buildings to be free of ACM, in some circumstances, such as where ACM is in good condition and assessment reveals it does not pose a significant threat to health, maintenance in situ is a better alternative than removal. Unnecessary asbestos removal may pose a higher risk than simply maintaining asbestos in place, particularly in light of concerns that a lack of awareness and knowledge may be resulting in non-compliance when handling and removing asbestos. No information was found to suggest that the systematic removal of ACM over maintaining these materials in situ is recommended in any country.

The advice available suggests that asbestos should only be removed if it is found to pose a significant risk to health or if the opportunity for removal arises due to demolition or refurbishment works in the affected building. In either situation, the appropriate guidelines for asbestos removal or maintenance must be followed.

References

ACT Asbestos Task Force website: http://www.asbestos.act.gov.au/asbestos_task_force.html

ACT Asbestos Task Force 2005a. *Asbestos Management in the ACT*. ACT Government, Canberra, Australia.

ACT Asbestos Task Force 2005b. Final Report on Focus Groups among the General Public, and Tradespeople. ACT Government, Canberra, Australia.

Australian Safety and Compensation Council (ASCC) 2008. A literature review of Australian and overseas studies on the release of airborne asbestos fibres from building materials as a result of weathering and/or corrosion, Canberra, Australia. Accessed on line at: http://www.ascc.gov.au/

Bard D & Burdett G 2007. Exposure of UK Industrial Plumbers to Asbestos, Part II: Awareness and Responses of Plumbers to Working with Asbestos During a Survey in Parallel with Personal Sampling. *Annals of Occupational Hygiene*, 51 (2):113–119.

Building and Woodworkers International (BWI) & the International Ban Asbestos Secretariat (IBAS) 2006. *Chrysotile asbestos: hazardous to humans, deadly to the Rotterdam Convention*. Accessed online at: http://hesa.etui-rehs.org/uk/dossiers/files/chrysotileasbestos.pdf

Burdett G & Bard D 2007. Exposure of UK Industrial Plumbers to Asbestos, Part I: Monitoring of Exposure Using Personal Passive Samplers. *Annals of Occupational Hygiene*, 51 (2):121-130.

Burdett GJ & Jaffery SAMT 1986. Airborne asbestos concentrations in buildings. *Annals of Occupational Hygiene*, 30 (2):185-199.

Burdett GJ, Jaffrey SAMT & Rood AP 1989. Airborne asbestos fibre levels in buildings: a summary of UK measurements. In: *Non-occupational exposure to mineral fibres* (eds: Bignon J, Peto J and Saracci R) 1989: 277-290. IARC Scientific Publications no. 90, International Agency for Research on Cancer, Lyon.

Engholm G & Englund A 2005. Asbestos hazard in the Swedish construction industry – recent trends in mesothelioma incidence. *Scandanavian Journal of Work Environment Health,* 31(2):27-30.

Enhealth and the Department of Health and Ageing 2005. *Management of asbestos in the non-occupational environment*. Accessed online at: http://www.health.gov.au/internet/main/publishing.nsf/Content/FB262D7C35664103CA257420001F2D74/$File/asbestos.pdf

Esmen, N. 2001. The costs of imprecision: perspectives in asbestos abatement. In: Landrigan, PJ and Kazemi, H eds. 2001. The Third Wave of Asbestos Disease: Exposure to Asbestos in Place*. Annals of the New York Academy of Sciences*. Vol 643. pp. 582-588.

Hays SM 1994. National Institute of Building Sciences: Recommended practices and procedures for operations and maintenance. *Applied Occupational and Environmental Hygiene*, 9 (11): 799-807.

Heads of Workplace Safety Authorities (HWSA) 2007. *Campaign Report: Demolition and Asbestos Removal in the Construction Industry*. An Australian & New Zealand joint Compliance Campaign. Access online at: http://www.hwsa.org.au/files/documents/Activities%20-%20Campaign%20Final%20Reports/6a3c1ebe-3a3b-4d0d-bc64-be7a56fb3571.pdf

Health Effects Institute – Asbestos Research. 1991. Asbestos in public and commercial buildings: a literature review and synthesis of current knowledge. Cambridge, MA. HEI-AR.

Health and Safety Executive (HSE) nd. A short guide to managing asbestos in workplaces.

Health and Safety Executive (HSE) 2008. *Manage buildings? You must manage asbestos*. Accessed online at: http://www.hse.gov.uk/pubns/manageasbestos.pdf

Health and Safety Executive (HSE) 2007. *Taking risks with asbestos: what influences the behaviours of maintenance workers?* Prepared by the Institute for Employment Studies for Health and Safety Executive (RR558, Research Report). Accessed online at: http://www.hse.gov.uk/research/rrhtm/rr558.htm

Health and Safety Executive. *The control of Asbestos Regulations 2006*. Statutory Instrument 2006 No. 2739. Access on line at: http://www.opsi.gov.uk/si/si2006/20062739.htm

Health Canada 2008. *Health Risks of Asbestos*. Accessed on line at: www.hc-sc.gc.ca/hl-vs/iyh-vsv/environ/asbestos-amiante-eng.php

Hughes, R.J. 1978. Asbestos. Mineral Industry Annual Review. Bureau of Mineral Resources Geology and Geophysics. Canberra: AGPS. Pp 61-62.

Jaffery SAMT, Burdett GJ & Rood AP 1988. An investigation of airborne asbestos concentration in two UK buildings: before, during and after the removal of asbestos. *International Journal of Environmental Studies*, 32 (2 & 3): 169-16

Leigh, J, et.al. 2002. Malignant mesothelioma in Australia, 1945-2000. *American Journal of Industrial Medicine.* 41: 188-201.

Lemen RA, Bingham EA 1994. Case study in avoiding a deadly legacy in developing countries. *Toxicology and Industrial Health*, 10 (1-2):59-87.

Major, G. 1968. Asbestos dust exposure. In: Proceedings 1st Australian Pneumoconiosis Conference. (Sydney). 467-474.

Martonik JF, Nash E and Grossman E 2001. The history of OSHA's asbestos rulemakings and some distinctive approaches that they introduced for regulating occupational exposure to toxic substances. *American Industrial Hygiene Association Journal*, 62 (2):208-217.

National Occupational Health and Safety Commission (NOHSC) 2005. *Code of practice for the Management and control of asbestos in workplaces* [NOHSC: 2018 (2005)], Canberra, Australia. Accessed online at: http://www.ascc.gov.au/

National Occupational Health and Safety Commission (NOHSC) 2005. *Code of Practice for the Safe Removal of Asbestos 2nd Edition* [NOHSC: 2002 (2005)], Canberra, Australia. Accessed online at: http://www.ascc.gov.au/

National Occupational Health and Safety Commission 1988. *Guide to the control of asbestos hazards in buildings and structures* [NOHSC:2002(1988)], Canberra, Australia.

New Zealand Department of Labour 1999. *Guideline for the Management and Removal of Asbestos*. Wellington, New Zealand.

Roberts, C.G. and Whaite, H.M. 1952. A survey of dust exposure and lung disease in the asbestos cement industry in New South Wales. *Studies in Industrial Hygiene.* No. 24. NSW Dept of Health.

SafeWork SA 2006. Asbestos and the Home Mechanics: a basic guide on what you need to know about asbestos. Government of South Australia, Adelaide, Australia.

SafeWork SA 2006. Asbestos and the Home Renovator: a basic guide on what you need to know about asbestos. Government of South Australia, Adelaide, Australia.

Uhlig H & Whitaker DR 1991. When Managing Asbestos Means Leaving It Alone. *Risk Management,* 38 (8):33.

United States Environmental Protection Agency website. Accessed June 2008 at: www.epa.gov/asbestos

United States Environmental Protection Agency (EPA) 1990. *Managing Asbestos in Place: A Building Owner's Guide to Operations and Maintenance Programs for Asbestos-Containing Materials.* Accessed online at: http://www.wbdg.org/ccb/ASBMAN/20t2003.pdf

URS Australia Pty Ltd 2005 (August). *ACT Asbestos Surveys – Health Risk Assessment*. Prepared for the ACT Asbestos Task Force. ACT Government, Canberra, Australia.

Vitra RL 2006. *Worldwide Asbestos Supply and Consumption Trends from 1900 to 2003*. US Department of the Interior and US Geological Survey.

Wilson R et al. 1994. Asbestos in New York City Public School Buildings – Public Policy: Is There a Scientific Basis? *Regulatory Toxicology and Pharacology*. 20, pp. 161-169.

World Health Organization (WHO/SDE/OEH06.03) 2006. *Elimination of asbestos – related diseases*. Geneva, World Health Organization.

Reading list

Anonymous 1990. In-Place Management of Asbestos Increasing; Experts Say Awareness Still Is a Problem, *National Real Estate Investor*, 32 (12): 64.

Anonymous 1993. Asbestos control: Alternative to removal - Effective O&M program is cost efficient and keeps conditions safe. *Chain Store Age Executive with Shopping Center Age*, 69 (1):184.

Anonymous 1994. New custodian work practices reduce asbestos exposure risk. *Facilities Design & Management*, 13 (10):10.

Collegium Ramazzini Call for an International Ban on Asbestos (Editorial), 2005. *American Journal of Industrial Medicine*, 47: 471-474. Access online at: http://hesa.etui-rehs.org/uk/dossiers/files/AsbestosBan2005.pdf

Department of Housing and Works, Western Australia 2004. *Whole of Government Management of Asbestos Issues: Information Guide for Agencies*. Access online at: http://www.dhw.wa.gov.au/Files/about_asbestos0708.pdf

Global Environment & Technology Foundation 2003. *Asbestos strategies: Lessons Learned About Management and Use of Asbestos*. Report of findings and recommendations On the Use and Management of asbestos, prepared by Global Environment & Technology Foundation, May 2003, Virginia, US. Access online at: http://murray.senate.gov/asbestos/Asbestos_Strategies_Report.pdf

International Ban Asbestos Secretariat (IBAS). Asian Asbestos Conference 2006. *Protecting people from Asbestos*. Bangkok, Thailand, July 26-27 2006. Access online at: http://www.btinternet.com/~ibas/lka_asia_asb_conf_aac_2006.htm

International Ban Asbestos Secretariat (IBAS). European Asbestos Conference 2005. *Policy, Health and Human Rights*. Brussels, Belgium, September 22-23, 2005, Access online at: http://www.btinternet.com/~ibas/lka_eac_05_rep.htm

Longo WE, Egeland WB, Hatfield RL & Newton LR 2002. Fiber Release During the Removal of Asbestos-Containing Gaskets: A Work Practice Simulation. *Applied Occupational & Environmental Hygiene*, 17(1): 55-62.

Madl AK, Clark K. & Paustenbach DJ 2007. Exposure to Airborne Asbestos During Removal and Installation of Gaskets and Packings:

A Review of Published and Unpublished Studies. *Journal of Toxicology & Environmental Health: Part B*, 10 (4): 259-286.

Ministry of Health 2007. The Management of Asbestos in the Non-occupational Environment: Guidelines for Public Health Units: Revised edition 2007. Wellington: Ministry of Health.

Swedish Work Environment Authority 2006. Asbestos: Ordinance of the Swedish Work Environment Authority containing Provisions on Asbestos, together with General Recommendation on the implementation of the Provisions. The Work Environment Authority's Status Book.

Yeung P, Patience K, Apthorpe L & Willcocks D 1999. An Australian study to evaluate worker exposure to chrysotile in the automotive service industry. *Applied Occupational and Environmental Hygiene,* 14 (7): 448-57.