2 Maintaining a safe environment: 1901 onwards

'Australians are entitled to live in a safe and healthy environment.'
– The National Environmental Health Strategy, 2000, p. 5.[152]

At the beginning of the 20th century, the focus of environmental health activity was on public engineering and sanitation, in order to provide safe drinking water and remove waste (e.g., 'nightsoil' or sewage, and industrial waste), and the elimination of housing slums. Later, the large-scale implementation of sanitation prevented the spread of infectious diseases and safeguarded the environment. The application of housing standards, building codes, and land use planning resulted in better housing and less overcrowding.[153]

By the end of the 20th century, a high standard of environmental health was the norm for most people in Australia. The housing and environmental health of many Aboriginal and Torres Strait Islander communities, however, fell far short of that enjoyed by other Australians.[154] Results from the *2001 Community Housing and Infrastructure Needs Survey* for Indigenous communities indicated that around one in four permanent dwellings 'were in poor condition, needing major repair or replacement' (27%, down slightly from 29% in 1999).[155]

There were some improvements: a reduced proportion of the population living in temporary dwellings; a larger proportion of permanent dwellings connected to water, power and sewerage systems; and fewer communities with more than 50 people experiencing sewerage system overflows and leakages (48%, down from 59% in 1999). A range of further measures was put in place to address the poorer environmental health of many remote and rural Indigenous communities (e.g., training and employment of Environmental Health Workers, remedial housing health hardware programs).[156]

The 2005 Productivity Commission report, *Overcoming Indigenous disadvantage*, identified 'effective environmental health systems' as an area for action:

- to reduce rates of water and foodborne diseases, trachoma, tuberculosis and rheumatic heart disease (diseases associated with poor environmental health);
- to improve access to clean water and working sewerage systems; and
- to reduce overcrowding in housing.[157]

Environmental health and housing in remote Indigenous communities remained areas of public health concern, as they are critical determinants of health and wellbeing for Aboriginal and Torres Strait Islander peoples. The development of an Indigenous environmental health workforce, a long-term strategy to improve housing and health infrastructure in remote communities, and growing community awareness of the importance of environmental health, were steps towards improving the health of these Australians (Box 2.1).[158]

Across Australia, other initiatives included better control and reduction of environmental poisons (e.g., lead and asbestos) through the implementation of broad strategies such as the removal of lead from petrol and paint, the closure of asbestos mines and nation-wide banning of asbestos and products containing asbestos (Sections 2.1 and 2.2). However, human exposure to many chemicals remained a concern.

Urban air quality improved after the first *Clean Air Acts* in 1967, and there was continuous monitoring of certain pollutants, as well as the setting of national ambient air quality standards (Box 2.2). Levels of passive tobacco smoking were reduced by laws to make workplaces and public spaces smoke-free, and by media awareness campaigns to reduce children's exposure to tobacco smoke in homes and cars (Section 1.1). However, general indoor air quality required coordinated attention, as Australians as a whole spent up to 90% of their time indoors.[159]

Box 2.1 Housing for Health, 1985-

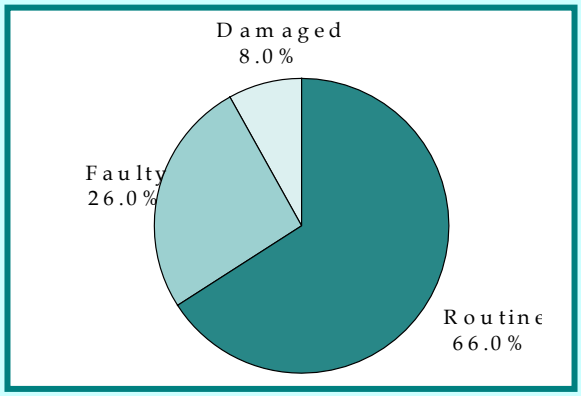
Indigenous community and state-based Housing for Health (HfH) projects operated from 1985.[160] In 1987, Nganampa Health Council developed 'Healthy Living Practices' and demonstrated that improvements in the health hardware of housing in Indigenous communities halved the incidence of skin and eye infections.[161] (Health hardware refers to those items in a house that assist in maintaining the health of the occupants). In methodology developed by the Council, nine essential healthy living practices were developed: washing people; washing clothes/bedding; waste removal; nutrition; reduced crowding; separation of dogs and children; dust control; temperature control; and reduced trauma.

Fixing Houses for Better Health (FHBH) began in 1999 as a collaborative program between Healthabitat, ATSIC, state/territory Aboriginal and Torres Strait Islander housing agencies and health departments in NSW, Qld, SA, WA and NT, using the HfH approach to make urgent safety and health hardware repairs to existing housing and living areas.[162]

In 2001, Australian Housing Ministers announced a ten-year plan for new directions in Indigenous housing and environmental health.[163] The (then) Department of Family and Community Services (FaCS) allocated $9m for FHBH projects over four years, to survey and fix 1,500 houses in remote Indigenous communities. The success of HfH and FHBH projects relied on immediate action and the principle of 'no survey without service' (framed by the late Dr Fred Hollows).[164] FHBH projects were evaluated as successful in fixing critical health hardware deficiencies of houses in participating communities, the delivery method was endorsed, and further funds were allocated in 2005 to extend FHBH projects and associated research and development.[165]

Accurate data from the projects enabled the debunking of the myth that 'housing was poor because it was damaged by community members'.[166] As indicated in Figure 2.1, faulty work and (unmet) need for routine maintenance were the more significant reasons.

Figure 2.1: Reason fix required, national fix work data as recorded by licensed trades, 1999-2005



Source: McPeake & Pholeros, *National Housing Conference 2005*, 2005, p. 5.

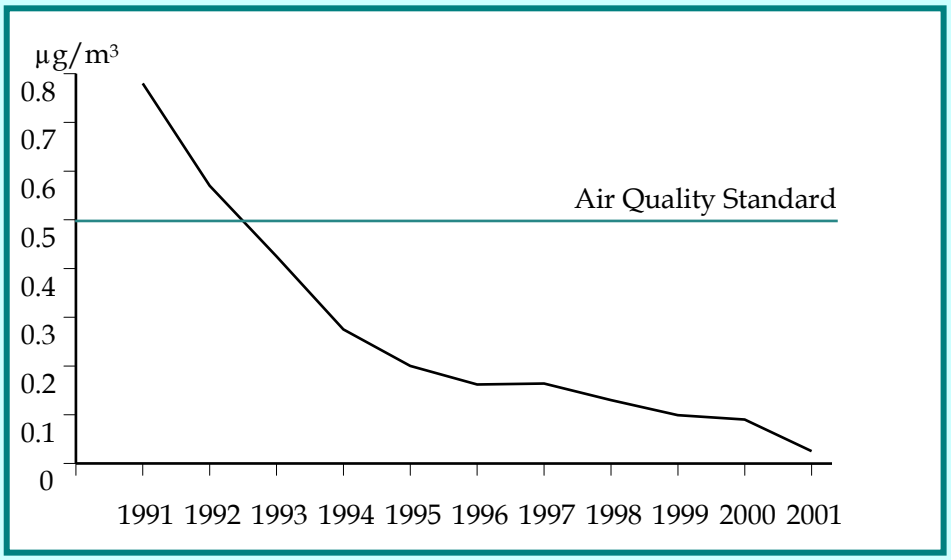
Nationally, there was greater community awareness of the state of the environment, demonstrated by activities such as rubbish recycling schemes, the annual 'Clean up Australia' day and other community-led projects. In many of these, the public health sector played an active role.

The future health consequences of global climate change, however, required further effort from environmental health and public health practitioners. Impacts in Australia were likely to include increases in heat- and flood-related deaths and injuries, and the expansion of geographic areas susceptible to the transmission of tropical infections such as dengue fever and malaria. More research would be needed to identify the best ways in which humans could adapt to these changes. Some individuals and communities lacked the resources required to respond adequately, and remote Aboriginal communities, people on low incomes and elderly people were particularly vulnerable.[167]

Box 2.2 Improvements in urban air quality, 1967-

Reductions in air pollution delivered long-term benefits to the health of the population, and there were major improvements in urban air quality with the Clean Air Acts in the 1960s. Monitored airborne lead levels showed a decrease following the introduction of lead-free petrol in 1985. On 15 March 2000, the Australian government announced a phase-out of leaded petrol under the *National Fuel Quality Standards Act 2000* (Figure 2.2).[168] On 1 January 2002, the phase-out was completed. The *State of the Environment Report* (2006) described airborne lead concentrations as no longer of concern in urban areas.[169] Major urban centres also reported levels well below national standards for carbon monoxide, sulphur dioxide, and nitrogen dioxide.[170]

Figure 2.2: Trend in average annual airborne lead levels, 1991-2001



Notes: µg/m^3 = micrograms per cubic metre; graph based on national averages calculated from site-specific data.

Source: Department of Environment and Heritage, *State of the air: community summary 1991-2001*, 2004, p. 6.

Air quality improvements were also attributed to national controls on motor vehicle emissions, better motor vehicle design (especially in emissions' control technologies such as catalytic converters), and new fuel standards.[152,171] Stringent new vehicle emissions' standards for diesel and petrol vehicles, and changes to Australian Design Rules were implemented from 2002 to 2007 as part of the Australian government's 1999 *Measures for a Better Environment* tax package. Despite these improvements, motor vehicle-related ambient air pollution in 2000 was still estimated to cost approximately $2.7 billion annually. The economic benefits of reducing air pollution included productivity gains (e.g., employees needing fewer sick days) and savings in health expenditure (e.g., fewer cardio-respiratory deaths and illnesses requiring treatment in hospital).[172] Other air pollutants, particularly ozone and particle levels, were high relative to air quality standards.[152]

Public health principles and practices

The *Australian Charter for Environmental Health* contained a set of nine principles: human health protection; interrelationships between economics, health and environment; sustainable development; local and global interface; partnership and cooperation; risk-based assessment and management; evidence-based decisions; efficiency; and equity.[173] Public health practitioners helped to develop a suite of protective responses to environmental health risks. Safeguarding environmental health continued to develop as a successful instrument against a range of potentially hazardous exposures. Two major challenges to attaining equitable environmental health management still existed:

- ensuring access to safe and healthy environments for rural and remote Indigenous Australian communities; and
- safeguarding the quality of environments for the health of future generations.[174]

These two challenges formed the environmental health justice component of the *National Environmental Health Strategy implementation plan*.

Table 2.1: Historic highlights of successful environmental health strategies

Asbestos	
1937-1966	Asbestos mining commenced at Wittenoom, WA until shut down in 1966.
1955	Asbestos identified as a cause of lung cancer.
1962	First reported case of mesothelioma; in retrospect, 658 cases in Australia from 1945-1979.
1970s	Peak of asbestos product manufacturing and consumption.
Late 1970s-early 1980s	A series of regulations adopted by the states imposed asbestos exposure limits.
1980	Australian Mesothelioma Surveillance Program commenced (later, the Australian Mesothelioma Register).
1983	Asbestos mining ceased in Australia with the closure of the Woods Reef mine in NSW.
1999	Risks of Chrysotile asbestos published.
2001	Workplace Relations Ministers' Council agreed to phase out all new chrysotile asbestos use by 2003.
2004	Asbestos and all products containing asbestos banned Australia-wide.
Lead	
1925	SA Royal Commission examined high numbers of lead-affected Port Pirie workers; research into lead effects on the local environment.
1969	NHMRC amended the Uniform Paint Standard to reduce the amount of lead in domestic paint to 1%.
1979	SA Port Pirie Cohort Study examined the effect of lead on the neurological development of children.
1984	SA Government set up Port Pirie Lead Implementation Program and remedial interventions commenced.
1993	NHMRC revised 1987 guidelines for lead in blood and ambient air.
1994	National Occupational Health and Safety Commission declared the National Standard for the Control of Inorganic Lead at Work and the National Code of Practice for the Control and Safe Use of Inorganic Lead at Work.
2001	Major urban centres reported airborne lead levels well below national standards.
2004	Continued funding of the SA Lead Program and a further review of the Program's goals and focus.
2006	National Industrial Chemicals Notification and Assessment Scheme (NICNAS) declared lead compounds in industrial surface coatings and inks as priority existing chemicals for health risk assessment with a view to eliminating their use.
Clean Air	
1960s	First Clean Air Acts introduced, e.g., the *NSW Clean Air Act 1961*.
1985-2002	Leaded petrol phased out.
1998	Ambient air quality standards and goals for six pollutants set.
2001	Major urban centres reported levels well below national standards for airborne lead, carbon monoxide, sulphur dioxide, and nitrogen dioxide.
2002-2007	Stringent new vehicle emission standards for diesel and petrol vehicles, and changes to Australian Design Rules (new vehicle emission standards and fuel standards) implemented.
2003	Air quality standards strengthened to address the adverse health impacts of small particle pollution.
Smoke-free premises	
1986	NHMRC reviewed the evidence on effects of passive smoking on health.
1987	Australian domestic airlines smoke free. Victoria - *Tobacco Act 1987* regulates smoking in public areas.
1988	All Australian government and Telecom offices made smoke free. State governments followed suit.
1997	Second NHMRC report on passive smoking produced and national response to passive smoking agreed.
1999	The *National Tobacco Strategy 1999 to 2002-03* endorsed.
2000	Australian Health Ministers' Advisory Council endorsed the national response to passive smoking in enclosed public places and workplaces.

2.1 Environmental lead reduction

1979 onwards

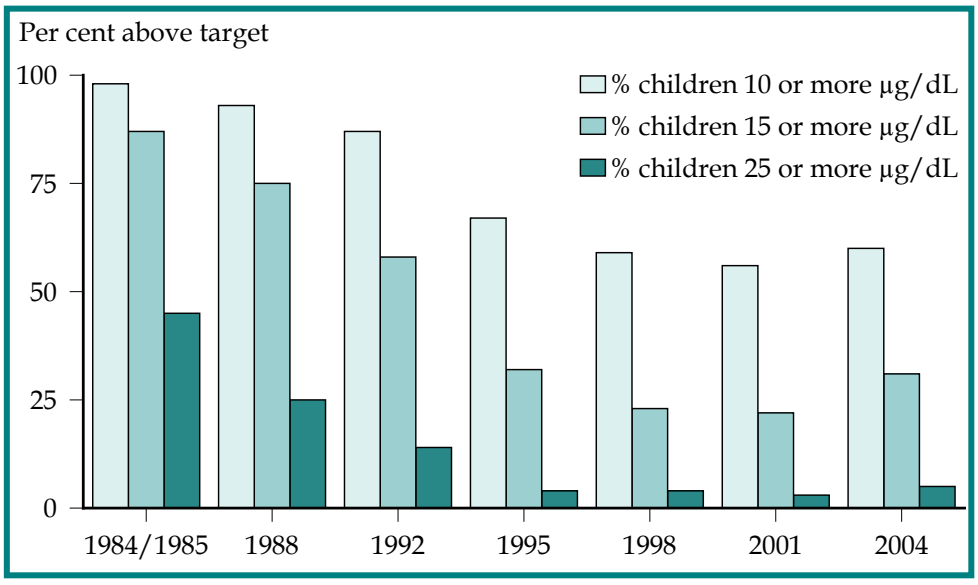
> *'There are no benefits of human exposure to lead and all demonstrated effects of such exposure are adverse' – National Health and Medical Research Council,* Revision of the Australian guidelines for lead in blood and lead in ambient air*, 1993, p. 1.*[173]

Lead accumulates in the body, and even small amounts of dust containing lead pose a health risk.[174] At the levels of lead exposure experienced by communities located near lead mines or smelters, there were significant neuro-behavioural effects on children's health and development, especially on their intellectual performance.[175] The youngest children were at greatest risk because of lead-ingesting behaviours (e.g., putting things in their mouths), increased ability to absorb lead and the susceptibility of their rapidly developing central nervous systems.[175,176] Evidence suggested that the intelligence quotients (IQ) of children could be reduced by up to five points for each 10µg/dL (micrograms per decilitre) increase in blood lead level within the range 10-25µg/dL.[175]

Public health research showed that there were measures that could be taken to reduce the impact of lead in the communities that were most affected (the 'point source communities'). Such sites included Port Pirie in South Australia; Broken Hill and Boolaroo in New South Wales; Mt Isa in Queensland; and other places in Australia where mining, transport, processing and shipping of lead had taken place.[177,178,179]

In 1925 in South Australia, a Royal Commission first investigated the high numbers of lead-affected Port Pirie workers. In 1979, the Port Pirie Cohort Study, funded by the SA Health Commission, began to examine the effects of lead on the neurological development of children. The Port Pirie Lead Implementation Program was established in 1984 in response to the environmental contamination that had accompanied a century of smelting, and a range of interventions followed. Over the 20 years of the program, dramatic reductions in blood lead occurred in Port Pirie. In 1984, 98% of young children exceeded the later NHMRC goal of 10µg/dL. This significantly improved with a fall to 55% by 2001. These reductions, however, reached a plateau and started to rise somewhat after 2001, serving as a timely reminder that Port Pirie was still the most contaminated area in Australia and much still remained to be done.[175]

Figure 2.3: Percentage of Port Pirie children aged 1-4 years with blood lead levels above target values, 1984-2004



Source: Maynard et al., *The Port Pirie Lead Implementation Program*, 2006, p. 25.

This example of a lead remediation program in a heavily polluted location showed that mitigating the effects of accumulated environmental lead on a community was a long-term project, requiring a sustained public health effort.

In 1993, the NHMRC revised the 1987 guidelines, and recommended a specific goal, 'to achieve for all Australians a blood lead level of less than 10 µg/dL (micrograms/decilitre or 0.49 µmol/L), of particular urgency for children aged one to four because of the known adverse effects of lead exposure on intellectual development'.[173] The aim was to achieve this in 90% of all children aged one to four years, by the end of 1998. The goal was achieved - the National Survey of Lead in Children in 1995 showing that 93% of the age group had blood lead levels below the NHMRC target. Seven per cent, or around 75,500 children, had blood lead levels above the target, and 2% (17,500 children) had blood levels that were notifiable (blood levels greater than 15 µg/dL). Mean blood lead levels were higher in those from socioeconomically disadvantaged households, in Indigenous children, in families with cars using leaded petrol, and in older homes that had paintwork in poor condition. The lowest levels were in children in the ACT, where there was a relative absence of heavy industry, and many of the surveyed children lived in houses built after the 1970s.[180]

There was also a reduction in lead levels in the air because of the progressive reduction of lead in fuels. Lead-free petrol became available across the country from 2002, and reduced population lead exposure was demonstrated by monitoring airborne lead levels (Box 2.3).

Over the decade to the year 2000, a decrease in the mean blood lead concentration in adults (mainly female) was observed, from 4.7 to 2.3 µg/dL, a decrease of about 5% per year (and comparable to that observed in other countries).[181] National air quality standards set out maximum allowances and specified measurement and sampling requirements, and there were also standards for drinking water, and occupational exposures.[182]

Public health principles and practices

Public health practice focused on populations at two levels: the overall population and the groups within it that were most affected and therefore at greatest risk. Standards and guideline setting, regulating, and monitoring all played a role. There were achievements in long-term public health programs to remediate lead-toxic environments, as demonstrated by the reduced blood lead levels of those living in affected communities such as Port Pirie. Other programs were less successful (e.g., in Broken Hill drought and wind stirred up lead-laden dusts and exposure levels, which had decreased, rose again).[183]

Remediation approaches that integrated a range of activities into a multi-focused strategy, included:

- population monitoring and active case finding;
- case management of identified cases;
- public education and health promotion;
- remediation of public land, and, in some cases, of private land and housing; and
- ongoing evaluation, research and development.[175]

There were also environmental controls on the disposal of lead-contaminated waste, and public guidance was widely available.[174]

In the occupational health area, the *National Standard for the Control of Inorganic Lead at Work* and the *National Code of Practice for the Control and Safe Use of Inorganic Lead at Work* were released in 1994, and aimed to 'progressively reduce lead exposure and blood lead levels to convert existing lead-risk jobs to non lead-risk jobs'.[184] There was routine monitoring of blood lead levels in people who were at high risk of occupational exposure (e.g., heavy industry and lead mine workers).

More generally, there was ongoing public health activity in setting and testing hazardous and risky lead exposure level standards, in researching how to best mitigate its effects, and in preparing educational material to warn of its hazards (e.g., warnings regarding domestic removal of lead paint).

The National Pollutant Inventory came into effect in 1998 after a three-year period of development, and held increasingly better data on sources of lead and compound emissions in Australia.[185]

Factors critical to success

Successful public health measures to counter environmental lead included:

> ***Survey respondent:*** *[Successful public health interventions have been] 'large scale and over time - all mining communities cleared out (asbestos), lead – removal from petrol, and abatement in communities.'*

- the introduction of lead-free petrol from 1985;
- the use of tarpaulins and other measures to limit lead dust escaping into the environment by covering lead loads transported from mines, often across long distances, to processing or shipping facilities;
- the removal of lead from paint: the Uniform Paint Standard was amended in 1969 to reduce the amount of lead in domestic paint to 1% (with States altering their relevant legislation soon after, e.g., amendments to the *NSW Poisons Act 1966* in 1972); and, from 1997, the limit was further reduced to 0.1%, well down from the 50% that was common for lead in paint in the 1950s (care had still to be exercised in relation to renovating or removing older paints);
- bans on lead shot in the duck season and over wetlands (from 1998 in the NT and SA; from 2001 in Victoria); and
- the increasing availability of lead-free products: by 2002, there were lead-free 'fishing sinkers, shot, bullets, flashing, PVC cable sheathing, PVC plastic products, mirror-backings, line-marking paints, solder, collectors' metal miniatures, chess pieces, artists' paints, industrial paints, and wicks for candles'.[186,187,188,189]

These programs all contributed to a healthier population by reducing environmental lead exposure.

In communities affected by environmental hazards such as lead, the interventions focused upon the whole community, especially children, who were most at risk. Programs represented sustained efforts over a long period of time, supported by substantial government investment. The most successful programs engaged the affected communities, conducted regular independent reviews of the effectiveness of program activities, disseminated findings widely, and had collective community agreement about necessary action.

The removal of lead from widely used products (e.g., petrol and paint) was achieved over a relatively short time, by balancing commercial interests and the public's health. Awareness of the dangers of lead exposure was raised in lead-affected communities, and more generally. Lead emissions and other sources of lead pollution were routinely monitored, as were human exposures to lead.

Future challenges

> *'As environmental exposure to lead declines for the whole population, continued specific attention is needed for children living in industrial areas.'*
>
> NR Wigg, *Journal of Paediatric Child Health*, vol. 37, 2001, p. 423.[190]

The *State of the environment report* (2006) found that, while urban air quality had continued to improve and lead concentrations were no longer of concern in urban areas, lead emissions in specific localities (e.g., Port Pirie, SA; Broken Hill, NSW; Mount Isa, Qld) remained problematic.[169] Exposure of lead-affected communities required ongoing attention, and more needed to be done to improve lead abatement at its source (e.g., reducing industrial emissions) and in transit (e.g., covering loads and stockpiles at ports).[186] The challenge was to work more closely with lead polluters to improve abatement and remediation measures, and investigate more effective preventive measures, especially for those young children most at risk.[191] Lead dust is an important source of dietary contamination as it

does not degrade, and better secondary processing to remove it from the soil system was required to limit contamination of the air, food and water.[181]

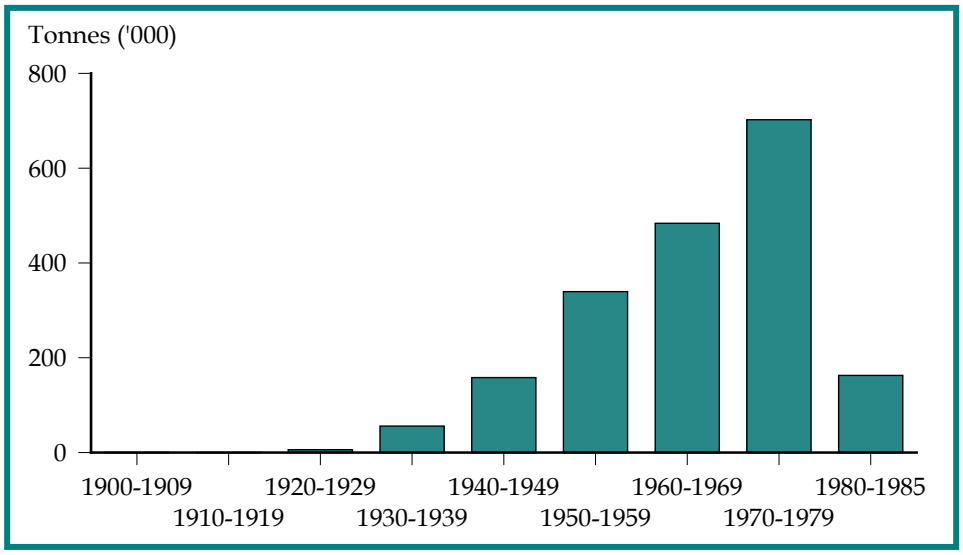
Evidence-based responses to environmental hazards tended to be slow, with lag times of sometimes more than 30 years before effective action was taken. A further public health challenge was to shorten the response interval in initiating preventive action.

2.2 Reduced exposure to environmental asbestos

1960s onwards

The mineral, asbestos, was widely used in many industries throughout Australia over the 20th century because of its strength, flexibility, and durability and its resistance to heat, acids and alkalis. The majority of asbestos used was incorporated into 'fibro' cement, i.e., cement reinforced with asbestos fibres, and formed into building materials, and pressure and sewerage pipes. By the 1950s, it was found in most homes, cars and workplaces. Australia was both an importer and exporter of asbestos, and a substantial local mining industry existed, exposing thousands of workers and their families to asbestos dust. In addition to mining and production, the export process (e.g., bagging, transport and wharf labour) also exposed many others to its hazards. By 1954, Australia was the fourth largest gross consumer of asbestos cement products in the world and the first on a per-capita basis.[192] A crude estimate of Australia's overall exposure, 'apparent consumption of asbestos' (the difference between amount produced and imported, and amount exported), is shown in Figure 2.4.

Figure 2.4: Apparent asbestos consumption, 1900-1985 (tonnes)



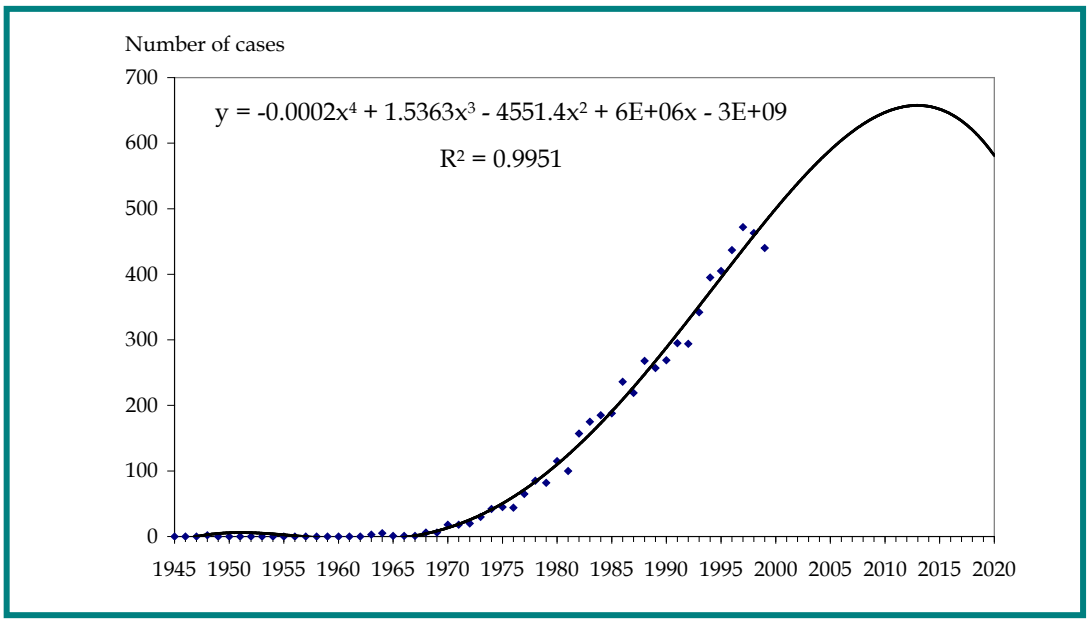
Source: Leigh & Driscoll, *International Journal of Occupational and Environmental Health*, vol. 9, 2003, p. 208.

By the end of the 20th century, asbestos was no longer 'mined, milled or manufactured' in Australia because of the known health risks.[193] However, much of the industry's output was still in use (e.g., in 'fibro' houses, power stations and in water and sewerage piping), and the risk of exposure remained high in certain industries and occupations.[192] There was relatively early recognition in Australia of the health risks associated with asbestos exposure and, in 1955, it was demonstrated that asbestos caused lung cancer.[3] Occupational exposures were estimated to be responsible for 15% of lung cancers in males, with air pollution possibly contributing a further 5% of cases.[194]

The first case of mesothelioma (a rare lung cancer that develops decades after asbestos exposure) was reported in 1962 in Wittenoom in Western Australia and, by 1969, another fourteen cases had been reported in Victoria and Queensland.[192,195] Research then demonstrated that nearly all human mesothelioma cases resulted from asbestos (or erionite) exposure, which could be very small. While there was a dose–response relationship with asbestos exposure, a threshold level was not identified

(studies showed that it was less than 0.15 fibre year/mL).[192] As Leigh and Driscoll commented, 'With this background, it was almost certain that Australia would suffer a severe mesothelioma epidemic' (Figure 2.5).[192]

Figure 2.5: Incident cases of malignant mesothelioma, 1945-1999, and extrapolated to 2020



Source: Leigh & Driscoll, *International Journal of Occupational and Environmental Health*, vol. 9, 2003, p. 214.

In 2001, the number of mesothelioma cases notified to the Australian Mesothelioma Program and Register from 1945 onwards totalled 7,027 (a further 488 notifications added to mid-2003 probably under-estimated the actual number of diagnosed new cases).[192] Notifications showed a continuing upward trend in both males and females, and Australia had the highest reported incidence of malignant mesothelioma in the world during the last two decades of the 20th century. Incident cases were not expected to peak until 2014, forty years after the maximum asbestos exposure period of the 1970s.

Public health principles and practices

The initial recognition of the link between respiratory exposure to asbestos and asbestosis, lung cancer and mesothelioma led to public health measures to reduce environmental asbestos as a hazard.[196] Asbestos was no longer mined in Australia, and at least one mine closure was related to its inability to meet occupational dust control regulations (although the international market for asbestos had also weakened). The asbestos mine at Wittenoom closed in 1966, and all asbestos mining ceased in Australia when the last mine (Woods Reef, NSW) ceased production in 1983.[197]

It was public health research that identified the problem from the 1950s, continuing into the 1960s and 1970s and led to action to prevent further exposure. Asbestos exposure was significantly reduced by closing asbestos mines and their proximate townships, and by asbestos fibre control (from the 1980s). The Australian Mesothelioma Surveillance Program (later known as the Australian Mesothelioma Register) began in 1980.[198] Using its data, occupational and industrial links were established and lifetime risks of mesothelioma were calculated for a range of occupations.[199]

From the late 1970s to the early 1980s, a series of regulations were adopted by individual jurisdictions to impose limitations on asbestos exposure. Asbestos use in motor vehicle parts such as brake linings and clutch plates was phased out, but products used in the construction industry remained in many older buildings. The Workplace Relations Ministers' Council agreed to support the phasing out of all new chrysotile products (a form of asbestos) by 2003, and, from 31 December 2003, asbestos and products containing asbestos were banned and could not be imported, stored, supplied, sold, installed, used or re-used in Australia.

Strict precautions also governed the removal and disposal of asbestos and asbestos-containing materials.[193] For instance, occupational health and safety regulations stipulated that asbestos-containing material could only be removed by licensed removalists; and the transport and disposal of asbestos waste was regulated by the Environment Protection Authority, which specified safe handling and disposal methods through special licensing.

Factors critical to success

Large-scale interventions, such as the closure of mines and townships, had a relatively quick impact on reducing associated exposures to asbestos. Control measures were put in place to limit the risks of domestic, occupational and industrial exposures, and to manage asbestos risk reduction and removal.[197]

> ***Survey respondent:*** *'Asbestos fibre control [has been a public health success] - while we are still seeing a terrible toll in terms of mortality (mesothelioma and lung cancer) and to a lesser extent morbidity (asbestosis) from this today, it would have been orders of magnitude worse without prompt action to reduce exposure during the 1980s.'*

The Mesothelioma Register played an important role in focusing attention on the health problems posed by asbestos; and there was ongoing monitoring of the health of those affected by asbestos exposure. By the end of the century, there was state and national government support for appropriate compensation for those affected by asbestos exposure. In 2006, The Asbestos Diseases Research Centre at the University of Western Australia was set up to research mesothelioma and new methods of treatment.

Future challenges

Ongoing challenges included the risks to communities that were still being exposed to asbestos environmentally (i.e., naturally, or through windblown tailings) and domestically (e.g., through use of asbestos in older buildings). There were significant numbers of people who had already been exposed, or might yet be exposed in older domestic settings, and whose health needs would lead to future costs for the health care system. It was estimated that the number of mesothelioma cases would grow to around 18,000 cases by 2020, with the additional case load for asbestos-related lung cancer expected to be around 30,000–40,000 cases (two cases of asbestos-related lung cancer for every one case of mesothelioma).[192] About 11,000 of the expected mesothelioma cases were still to appear, creating a substantial future demand for clinical management, and for compensation.[192,200,201]

As with lead, the challenge was to manage the tension between economic benefit and the risk to public health, to speed up effective responses to environmental threats, and to reduce the liability caused by external costs imposed on the wider community (and hence, borne by governments and citizens rather than the polluter).[168]

2.3 Reducing the health effects of passive smoking

1995 onwards

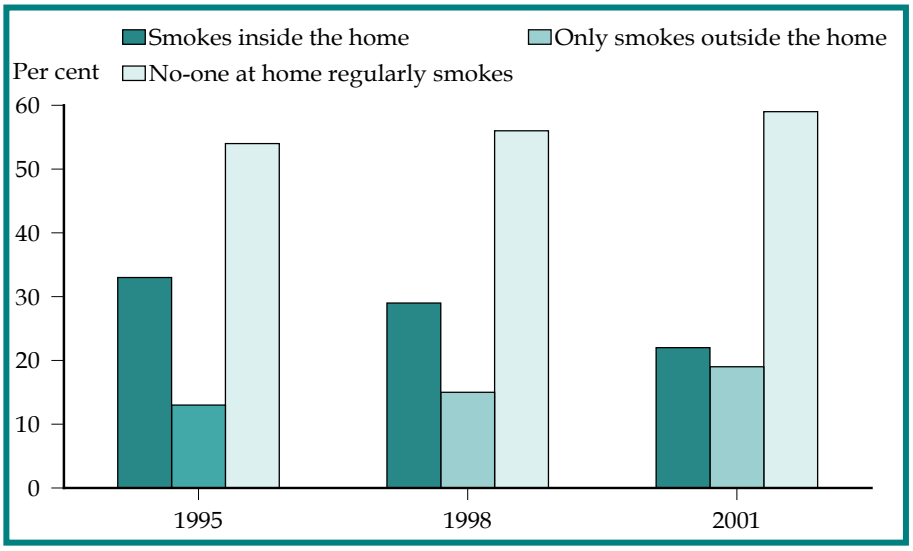
Public health studies demonstrating the adverse health effects of passive smoking in adult non-smokers first appeared in the early 1980s, and, by 1995, over 600 published medical studies linked exposure to environmental tobacco smoke (ETS) with lung cancer and other respiratory diseases.[203] In 1987, the NHMRC review on the evidence of health effects of passive smoking concluded that it was a cause of respiratory illness and contributed to the symptoms of asthma in children.[218] Then, research showed that passive smoking contributed to Sudden Infant Death Syndrome (SIDS) and developmental delay in children.[204,205] Furthermore, the risk of heart attack or death from coronary heart disease was estimated to be 24% higher in non-smokers who lived with a smoker.[218]

Legislation, regulation and other initiatives to highlight public awareness of the dangers of passive smoking (inhalation of ETS) resulted in large increases in the number of premises that were tobacco smoke-free. These included workplaces (where some of the first bans on smoking inside were put in place), public spaces and commercial buildings. By 2000, many jurisdictions had controlled exposure to ETS by regulating against smoking in public buildings, and smoking had been banned on all forms of public transport, in cinemas, theatres and concert halls, and increasingly in shopping centres and restaurants.[206,152]

Both smokers and non-smokers benefited from smoke-free premises. In a review of studies on the impact of smoke-free workplaces, Chapman and colleagues found a reduction in the number of cigarettes consumed (i.e., smokers smoked less) and in the prevalence of smoking (i.e., some people quit smoking when their workplaces became smoke-free).[206] They estimated that around 22% of the 2.7 billion cigarette decrease in cigarette consumption from 1988 to 1995 was attributable to smoke-free workplaces. A longitudinal study that sampled a cohort of workers in 1993 and 2001 confirmed that smoke-free workplaces were a significant factor in increasing the proportion of workers who reduced their cigarette consumption, and of those who stopped smoking altogether. [207]

Most importantly, results from population surveys demonstrated a reduction in the proportion of people smoking inside homes with young children (Figure 2.6).[208] This reflected a significant change in community behaviour and attitudes.

Figure 2.6: Proportion of population smoking in homes with young children, 1995, 1998 & 2001



Source: National Health Performance Committee, *National report on health sector performance indicators 2003*, 2004, p. 41.

When smoke-free premises' legislation was first mooted, many industry groups argued that the legislation would result in 'economic ruin' because of a loss of customers and that it was unnecessary

and unworkable.[209] However, these predictions did not eventuate.[210,211] Laws that initially restricted and then eliminated smoking in public premises limited opportunities for smoking, and reduced the social acceptability of smoking in enclosed spaces.[209]

For example, a survey of adult South Australians conducted in 2005, examined the effect of phasing in smoke-free laws and found that there was high community awareness of, and support for, smoke-free premises' laws, and the laws had not reduced the patronage of licensed premises.[209]

This legislation was an effective public health measure because the behaviour modelled in social settings such as licensed premises (e.g., bars and clubs) potentially affected social norms.[212] It was also likely that, as children's main exposure to ETS occurred in family homes and cars, the adoption by adults of voluntary smoking restrictions would substantially reduce children's exposure.[213]

> *'Smoke-free restaurants do not require "smoking police" to enforce bans, present few ongoing difficulties for staff, attract many more favourable than unfavourable comments from patrons, and do not adversely affect trade.'*
>
> —Chapman, Borland & Lal, *Medical Journal of Australia*, vol. 174, 2001, p. 512.

Public health principles and practices

Smoke-free premises' legislation took both a population and an environmental health approach to decreasing levels of passive smoking. The Australian government led by example, implementing smoke-free workplaces and public spaces in areas under its jurisdiction. It also played a role in providing evidence on the harmful effects of ETS through the NHMRC reports, and in encouraging state and territory governments to make the necessary legislative and regulatory changes.

Australian government smoking bans were introduced in all federal government and Telecom buildings in 1988, as well as in aircraft, buses and coaches that were registered under the Federal Interstate Registration scheme, and in domestic aircraft and airports operated by the Federal Airports Corporation.[214] The state governments followed soon after - in Western Australia for example, the public service became a smoke-free workplace in 1989, and smoke-free areas were extended through the *Health Act 1911*, the *Tobacco Control Act 1990* and *Occupational Health and Safety Regulations 1996*.

After the release of the NHMRC's scientific information paper on passive smoking in 1997, the Australian government determined that, as a major public health issue, passive smoking warranted a national response.[4,215] By the time of the first *National Tobacco Strategy* in 1999, it was considered that extending smoke-free workplaces and public places could not be achieved by 'education, information, common courtesy, voluntary codes and other forms of self-regulation' alone, and that 'legislation would be the most effective strategy for significantly reducing exposure' to ETS.[216]

The Legislative Reform Working Group of the NPHP, working in consultation with state and territory government tobacco control policy officers, developed the *National response to passive smoking in enclosed public places and workplaces* to assist these governments to review existing, and enact new legislation on passive smoking.[215] The national response was also intended to assist jurisdictions take action on one of the six key objectives of the *National Tobacco Strategy 1999 to 2002–03*: reducing exposure to tobacco smoke, through, for instance, 'establishment of smoke-free environments (both private and public) as the norm'.[216] It included guiding principles (Box 2.3) as well as model legislation, and was endorsed by the Australian Health Ministers' Advisory Council in 2000.[217]

Box 2.3 Smoke-free public places' and workplaces' legislation: Guiding principles

1. People have a right to participate in the life of the community without risks to their health from environmental tobacco smoke exposure. This right can be most effectively safeguarded in enclosed and in confined public places, where non-smoking is the normal practice.

2. There is no 'right to smoke' in an enclosed public place or workplace.

3. Non-smoking requirements should be designed to apply equally to all premises within a given industry sector in order to facilitate equal treatment of premises, and to promote community awareness, understanding and compliance.

4. A successful transition to 'non-smoking as the norm' may involve phasing-in arrangements for some types of premises.

5. Compliance systems should be based primarily on awareness, education and community support.

Two additional principles for legislative approaches to smoke-free workplaces specified that:

1. Public areas of workplaces should be non-smoking.

2. A non-smoking work environment should be regarded as the norm.

Source: National Public Health Partnership (NPHP), *National response to passive smoking in enclosed public places and workplaces - guiding principles for smoke-free public places and workplaces legislation*, NPHP, Melbourne, 2000, pp. 2-4.

The Australian government then encouraged state and territory governments to take further action to limit the ETS exposure of children in cars. Tasmania and South Australia were first to ban smoking in cars when children were present. The involvement of public health practitioners in encouraging parents to reduce ETS exposure in the home and car and, ideally, to opt for smoke-free environments, was an important public health approach to reducing ETS-related morbidity.[218] For example, the NSW Environmental Tobacco Smoke and Children community education project, which aimed to raise awareness of the risks associated with passive smoking, and provide parents and carers with ways to minimise children's exposure, surveyed adults in NSW where there was a smoker and young children in the household and found that:

The ETS and Children Project

- smoke-free homes increased from 47% in 2002 at the start of the campaign, to 73% in 2005;
- smoke-free cars had a similar increase - from 43% in 2002 to 61% in 2005; and
- there were significant changes in attitudes and knowledge, with people surveyed after the campaign more likely to agree that exposing children to ETS in the home and car would affect children's health.[219]

Research revealed that objective measures of ETS exposure (e.g., bio-markers such as urinary cotinine) were, to some extent, higher that those based on self-report.[220] However, these survey responses demonstrated what could be achieved by increasing public awareness and access to information resources for parents and carers, early childhood education and health practitioners, and policy makers.

Factors critical to success

The leadership of the public health practitioners and researchers who first advocated reducing the harms arising from ETS exposures was vital to the success of subsequent interventions. The Australian government played a significant role in reducing ETS exposure through the introduction of smoke-free premises in the late 1980s, and through its encouragement of the states to take similar action. Another

factor was the willingness of local, state and territory governments to regulate and legislate for the introduction of smoke-free workplaces and premises.

Community support for, and compliance with the introduced restrictions was also an important factor behind the increasing public health success of smoke-free premises, with early compliance by patrons.[211] Perhaps the greatest contributor to the success of smoke-free premises was the gradual nature of the changes that were introduced (although some public health commentators described the thirty-year period taken to ban smoking in enclosed spaces, as change 'moving at glacial pace'). Nevertheless, the fact that these initiatives were also accompanied by public health information, health promotion, and community awareness-raising resulted in a major shift in public attitudes towards the social unacceptability of smoking. Legislative change proceeded in partnership with social change.

> ***Survey respondent:*** *'Smoke-free premises and the control of air pollution in or caused by industry have reduced the burden of chronic respiratory disease and can be expected to reduce it further.'*

Cost-effectiveness

Abelson and colleagues estimated that, over the thirty years from 1970 to 2010, government investment in programs to reduce tobacco consumption *per se* produced a saving of about $2 for every $1 of expenditure, with 17,400 premature deaths averted.[221] Further benefits could be accessed if exposures of children to ETS in early life were reduced, as they resulted in developmental delay as well as childhood asthma and an increased risk of cancer.[221]

In terms of benefits to business (excluding the tobacco industry), although there were fears that smoke-free premises' legislation would be costly, most businesses reported the opposite. Early changes were to a large extent 'self-policing' with businesses (in this case, 82% of surveyed restaurateurs) reporting that implementation of the law required little effort and no expenditure on their part.[220]

Future challenges

Future challenges lay in further reducing passive smoking in all states and territories, and in maintaining community compliance and cooperation. The reduction (followed by elimination) of children's exposure to ETS needed to be a national priority. Research conducted for the *National Drug Strategy* in 1995 estimated that around 1.7 million children were potentially exposed to tobacco smoke in Australian homes, with the largest proportion (41.7%) being those aged up to five years old, when the impact of ETS was greatest and developmental delay most likely to occur.[220,218]

Although evidence indicated that socioeconomically disadvantaged areas and households (including those of Indigenous Australians) had higher rates of smoking and of children's exposure to ETS (in homes and cars), the NSW Population Health Survey quantified this difference. It showed that, while 89% of households with children 0-8 years were smoke-free overall in 2003-2004, this varied from 82% of the one fifth of households that were most disadvantaged, to 95% of the one fifth of households that were least disadvantaged.[222] Other factors that made a difference were the age of the mother and whether she had tertiary educational qualifications. In order to achieve equity in terms of giving every child the best chance to grow up in a smoke-free environment, effective public health action to reduce ETS exposures of children in the most disadvantaged households across Australia was necessary.