

Review of volatile substance use among Aboriginal and Torres Strait Islander people

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No.16 February, 2016

Suggested citation

Marel C, MacLean S, Midford R (2015) Review of volatile substance use among Aboriginal and Torres Strait Islander people. Australian Indigenous HealthInfoNet.

This review – or an updated version can be viewed at:

<http://www.aodknowledgecentre.net.au/volatile-substance-use>

This review has been peer-reviewed

Introduction

Volatile substance use (VSU) is an issue of concern to Aboriginal and Torres Strait Islander and non-Indigenous Australians. In locations where it is occurring, it impacts considerably on families and broader communities [1, 2]. An increasing number of reviews, reports and inquiries have been conducted over the past three decades, highlighting VSU as a critical issue [3-8]. In decades past the 'lack of progress in implementing recommendations contained in these reports created much frustration and despair in communities' [9 p.xv]. In recent years, however, there has been significant progress, particularly in remote Indigenous communities, though there is still work to be done [10-12].

About this review

The purpose of this review is to provide a comprehensive synthesis of key information on VSU for people involved in Aboriginal and Torres Strait Islander health in Australia, and draws on a number of substantial reports and other key documents. This review expands on the previous version of the *Review of volatile substance use among Indigenous people* [13], which itself drew on work conducted in preparation for *Volatile substance misuse: a review of interventions* [14].

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The current review is focused on Australian Aboriginal and Torres Strait Islander people, and does not substantially examine VSU among other Indigenous peoples, or other populations in Australia or internationally.

After a brief overview of the nature of volatile substances, the effects of VSU and current approaches to VSU are described. Specifically, supply and demand reduction approaches, and treatment responses in Aboriginal and Torres Strait Islander communities are discussed, followed by concluding comments.

Although there are numerous terms to describe inhalant use and misuse, often interchangeably, VSU is the term preferred in this review.

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About volatile substances

What are inhalants and volatile substances?

Volatile substances are chemical compounds that vaporise and release fumes at room temperature. They are also called 'inhalants' due to their method of administration [14]. Inhalants depress the central nervous system, and their use involves the deliberate inhalation of chemical vapours to produce intoxication or altered mental states [15]. The *Diagnostic and statistical manual of mental disorders* classifies these behaviours as 'inhalant intoxication', and 'inhalant use disorder' meeting two or more dependence criteria within a 12 month period [16].

There are approximately 250 different pharmacological and household products available in Australia capable of providing an intoxicating effect [17]. These products are generally classified into four main categories: volatile solvents, aerosols, gases and nitrates (Table 1) [15, 17, 18]. Nitrates are often not classified as volatile substances as they are used as sexual enhancers and are effective through the relaxation of the muscles without a direct effect on the central nervous system [17].

There are various methods of using volatile substances, the most common of which include, inhaling glue that has been squeezed into a plastic bag; saturating a cloth with a substance (e.g. petrol) and covering the nose and mouth or inserting the cloth directly into the mouth; sniffing directly from a container holding the substance; spraying aerosol directly into the mouth or into a balloon and inhaling the contents; and breathing in chrome paint that has been sprayed into a plastic or paper bag – also known as 'chroming' [21]. There are many different terms to describe VSU, including: volatile solvent, substance or inhalant abuse, use or misuse; petrol, paint or glue sniffing; snorting; chroming; huffing; bagging; popping or dusting [18, 21].

Effects of volatile substance use

The effects of the substances depend on the method of inhalation and the type of inhalant, as well as the age and gender of the user [21]. The chemicals in the inhalant are rapidly absorbed through the lungs and enter the bloodstream, where they are dispersed to the brain and other organs in the body [18]. The psychoactive effects of volatile substances are rapid and are similar to those of alcohol, such as slurred speech, impaired coordination, euphoria and exhilaration, dizziness, hallucinations and agitation [17, 22]. The use of inhalants, however, may produce a slightly different effect with intense feelings of intoxication at high levels, such as 'buzzing', 'rushing', with hallucinations and excitation [23 p.301, 24].

Despite the rapidity of effects, the complex solvents are highly fat soluble, and are quickly absorbed into the central nervous system [25-27]. Intoxication usually lasts only a few minutes, often leading to a desire to prolong the effects, and continued inhalation over the course of several hours. Continued inhalation increases the risk of loss of consciousness and suffocation. Hangover headaches and drowsiness from substances can be present for hours or days [18]. Chronic use can also result in damage to the kidneys, liver, heart and lungs [25, 28].

Tetraethyl lead is an organic hydrocarbon found in leaded petrol, the sale of which has been prohibited in Australia since January 2002. It is lipid-soluble, easily absorbed into the body when inhaled, and converted into triethyl lead in the liver [29]. Triethyl lead is neurotoxic and can be preserved in bone for more than 10 years, being rereleased into the bloodstream, even years after petrol sniffing has ceased [30-32].

Table 1. Examples of inhalants and their chemical components

Category	Inhalant	Chemicals
Aerosols	hair sprays deodorants spray paints fabric protector sprays computer cleaners asthma puffers	butane, propane butane, propane butane, propane, fluorocarbons, toluene, trichloroethylene butane, trichloroethylene dimethyl ether, butane, propane, <i>n</i> -hexane chlorofluorocarbons
Solvents	nail polish removers paint remover / thinners correction fluids and thinners permanent marker pens petrol	acetone, ethyl acetate, toluene toluene, methylene chloride, methanol, acetone, ethyl acetate, xylene, trichloroethylene, petroleum, distillates trichloroethane, trichloroethylene xylene benzene, toluene, <i>n</i> -hexane, xylene, possibly lead
Gases	fuel gas cigarette lighter fuel refrigerant	butane, propane butane, propane freon
Nitrates	poppers, fluids, room odorisers	amyl nitrate, butyl nitrite, cyclohexyl nitrite
Anesthetics	gaseous liquid local	nitrous oxide halothane, enflurane ethyl chloride
Cleaning agents	dry cleaners spot removers degreasers video head cleaners	tetrachloroethylene, trichloroethane, <i>n</i> -hexane xylene, petroleum distillates, chlorohydrocarbons tetrachloroethylene amyl nitrite, butyl nitrite, cyclohexyl nitrite
Food products	whipped cream aerosols (whippets)	nitrous oxide

Source: Galanter and Kleber, 2008; Lowinson, 2005 [19, 20]

Sudden sniffing death

The hydrocarbon gases present in some inhalants, particularly butane, propane and aerosols, appear to sensitise the myocardium to the effects of adrenaline, which can lead to sudden death by cardiac arrest. Also known as 'sudden sniffing death', a sudden surge of adrenalin (e.g. from being startled or agitated from a frightening hallucination or encounter with police) can lead to fatal cardiac arrhythmia, even in a single session in an otherwise healthy young person [15, 17, 18, 33].

Asphyxiation

Petrol sniffers face additional risk of death from asphyxiation and suffocation, most commonly as a result of falling asleep with containers against their faces or blankets over their heads, or from lack of oxygen in the lungs from inhaled petrol fumes [14, 18, 34].

There is still a risk of asphyxiation with low aromatic Opal¹ fuel, if used for the purposes of intoxication. Spraying the aerosol or propellant directly into the mouth can result in suffocation due to the cooling agents within the substance, which is also known as 'frozen larynx' [15]. In addition, death and injury can occur from convulsions, choking and fatal injuries from high-risk behaviour whilst intoxicated, as well as risks of burns or explosions from the substances [15].

Neurological and cognitive effects

Chronic VSU has been associated with cognitive abnormalities in the areas of motor skills, attention span, visual-spatial perception, memory, learning and executive functioning [29, 35, 36]. The first

¹ Opal fuel was the first low aromatic fuel to be introduced specifically as a supply reduction strategy for petrol sniffing, and to date, it is the only one available on the market. However, as new competitors are shortly expected to enter the market with alternative low aromatic fuels [10], the term 'low-aromatic fuel' (LAF) will be used in this review, despite the fact that 'Opal' fuel is most commonly associated with petrol sniffing prevention.

indication of impairment among chronic users is the progressive decline of cognitive functions, the degree of which is correlated with the severity and duration of use [15, 29, 35].

Longer-term central nervous system effects of VSU include brain dysfunction observed as cognitive impairment affecting memory, attention, and motor function, as well as dementia, depression and psychosis [37-39]. Behavioural and mood effects include hostility, apathy, lack of judgement and impaired performance in work and social conditions. Other lingering effects may occur such as dizziness, lethargy, and trance-like states [18].

In addition, the use of leaded inhalants can result in lead encephalopathy with seizures or death [40]. Tetraethyl lead has also been associated with intensified psychotic experiences, and is thought to be the cause of long-term neurotoxicity, and permanent cerebellar dysfunction in chronic users [38, 40-42]. Neurological dysfunction associated with lead encephalopathy includes tremors, convulsive seizures, severe movement abnormalities and loss of vision, which usually result in the need for emergency hospitalisation and prolonged intensive care treatment [29, 35]. Although the acute symptoms of lead encephalopathy may subside following treatment, cognitive impairments remain that differ from impairments associated with the use of substances that do not contain lead [29, 32].

The use of toxic hydrocarbons and tetraethyl lead by volatile substance users who have inhaled both leaded and unleaded petrol (particularly older petrol sniffers in Australia) is associated with the decline in neurobehavioural function [32].

Although there has been contention in previous research about whether cognitive recovery is possible among volatile substance users, recent research indicates that, for some, neurological recovery may be possible within weeks of abstinence, but be slower or permanent for chronic users [42, 43]. Significant cognitive recovery appears to be possible when abstinence occurs prior to development of cerebellar atrophy [29, 32, 35, 44]. However, long-term irreversible cognitive and neurological effects, such as cerebellar degeneration, seem to be particularly associated with the chronic use of leaded substances even after a substantial period of abstinence [29].

It should also be noted that assessing cognitive and neurological impairment in Indigenous Australian communities can be problematic due to the difficulties associated with the lack of validated culturally appropriate assessments. The majority of assessments are largely based on westernised systems, and are not validated among Indigenous population groups. As such, they are unable to take into account significant cultural and language barriers [36, 45], and there is thus an additional complexity to examining long-term effects of chronic VSU among Indigenous Australians.

Prenatal exposure to volatile substances

Due to their fat solubility, volatile substances are able to cross the placental barrier with ease. Prenatal exposure to volatile substances is associated with increased risk of low birth-rate, prematurity, delays in development, neurobehavioural problems and physical malformations [46].

Volatile substance use

A global perspective

VSU is an under-recognised problem worldwide, despite many countries reporting that it is problematic [47]. The use of volatile substances is reported in every region in the world, second only to cannabis use in many countries [48]. A compilation of data from various sources indicates that significant proportions of people have reportedly used a volatile substance at some stage in their life, with the highest proportions in Australia, Romania, Isle of Man, the United Kingdom (UK), the United States of America (USA), Kenya, Cyprus, and Ireland [47, 48].

Across the globe, higher than average use of volatile substances is seen among minority and marginalised young people, including Indigenous people in Australia, New Zealand, the USA and Canada [14, 49]. However, the relatively higher levels of VSU among these groups is more likely associated with socio-economic factors such as hunger, poverty, illness, low education levels, almost total unemployment, boredom and general feelings of hopelessness, which form the environment in which self-destructive behaviour takes place, rather than cultural attributes [14, 34].

It should be borne in mind that inhalant use is often considered 'illicit drug use' in countries other than Australia, making international comparisons very difficult. The *United States national survey on drug use and health* categorises inhalants as illicit drugs, along with marijuana, cocaine (including crack), heroin, hallucinogens, and non-medical use of prescription-type psychotherapeutics [50].

Volatile substance use in Australia

VSU predominantly occurs among young people, both Indigenous and non-Indigenous [51]. There are two general patterns of VSU in Australia. The first is the use of inhalants, which includes glues, deodorants, and spray paints (also known as 'chroming'), which is the most frequent form of VSU among Indigenous and non-Indigenous young people in urban areas [17, 52, 53]. The second pattern is the sniffing of petrol that primarily occurs in rural or remote communities [52]. Petrol sniffing does not appear to be common among volatile substance users in urban areas, possibly due to the availability and ease of accessibility of other intoxicating substances [17, 52].

VSU among the general population has been recorded in Australia since the 1970s. In a 1974 Queensland survey, 6.5% of school students reported they had used an inhalant [51]. During the 1990s, however, VSU in cities and towns became an increasing concern and a number of studies documented use by Indigenous and non-Indigenous people in locations ranging from large cities, such as Brisbane and Perth, to small regional towns, such as Alice Springs and Mt Isa [53-57]. Indigenous young people in these settings are likely to use volatile substances in greater quantities and for longer periods of time, although non-Indigenous young people and both Indigenous and non-Indigenous older people have also been identified as chronic users [1, 14, 56].

As with all substance use, VSU cannot be attributed to one cause, but rather has been associated with a range of risk factors. Marginalised Indigenous and non-Indigenous young people have indicated they use volatile substances as a way of relieving boredom, blocking hunger pains and coping with emotional distress [58, 59]. VSU is also commonly associated with socio-economic disadvantage, low education levels, almost total unemployment, general feelings of hopelessness and frustration, which contribute to form an environment where self-destructive behaviour occurs [34, 60].

It is also important to recognise the enjoyable aspect of VSU. Membership in a petrol-sniffing group offers young people excitement and a sense of identity among the few life opportunities experienced in some Aboriginal communities [14, 61]. VSU can also be a way of communicating identity, control and power. In Indigenous communities, VSU can be one of the few ways young people are able to exert power and control, partly through provoking reactions and partly through exercising control over their own bodies [8, 52, 62].

When examining explanations for alcohol or other drug use among Indigenous young people, disruption to culture, brought about by colonisation and dispossession, is often considered one of the primary contributing factors. One of the strengths of traditional culture is that it allows those within the community to retain strong connections with the land, culture and traditional spirits. However, it also presents a barrier for young people in the community, as they are able to conduct themselves with complete autonomy from a very young age [63, 64]. Community members are hesitant to interfere in other people's business, and there are widespread embedded notions about individual autonomy [Brady cited in 9].

Previous research has identified several risk factors for VSU in Indigenous communities, relating to cultural, situational, and individual factors. These include:

- social disadvantage
- family dysfunction

- cultural disruption
- low degree of community cohesion
- lack of physical and human resources
- poor access to resources and supports
- geographical location and, through this, access to substances
- peer groups and local patterns of use [60-62, 65, 66].

Understanding factors contributing to Indigenous VSU needs to go beyond individual explanations. VSU also needs to be considered within the broader context of community and cultural cohesion, in addition to the wider social and cultural impact of dispossession and dislocation that has occurred since European colonisation [61, 64, 67].

Petrol sniffing remains the most prevalent form of VSU among Indigenous people in remote communities, and has occurred in some Northern Territory (NT) communities since the 1940s. Sniffing in remote communities is thought to have originated when Aboriginal people observed American servicemen inhaling substances during WWII [68]. The first official documentation of petrol sniffing in Australia dates from 1950 at the Lee Brothers' sawmill on the Coburg Peninsula, NT, which noted the need to lock up petrol [62, 69]. Despite petrol being the 'drug of choice' for many children and teenagers in the 1970s and 1980s, by the 1990s, as surviving petrol sniffers grew older, sniffing became a kind of subculture. Young people in certain regions adopted distinctive clothing, listened to heavy metal music, and younger sniffers were 'inducted' by older ones who taught them how to steal petrol and personalise empty beer or soft drink cans [62, 68].

Unlike VSU in urban areas, which tends to be experimental and transitory among younger adolescents, the pattern of petrol sniffing in remote communities begins at a younger age and continues for a longer period of time [1, 14]. The majority of Indigenous petrol sniffers are between eight and 30 years old, primarily aged between 12-16 years, although there have been reports of sniffers aged as young as five years old [8, 9, 11]. Although occasional or experimental use of volatile substances appears most common, one study has indicated that the mean duration of use was eight years, increasing the risk of some substance users becoming chronic users as they age [2, 70]. While leaded petrol has not been available in Australia since 2002, it is likely that long-term chronic petrol sniffers have used a combination of leaded and unleaded petrol, which has implications for cognitive functioning [32].

Crucially, volatile substances are some of the most readily available and affordable methods of intoxication, accessible and easy to use when the opportunity arises [71].

Comorbidity

Although there has been little research on the psychological effects of chronic volatile substance use among Indigenous Australians, research conducted among other populations suggests that volatile substance users are at an increased risk of co-occurring mental health disorders [72-79]. In particular, inhalant users in other populations have illustrated higher rates of major depression, suicidal ideation and attempts, anxiety and personality disorders [76-79].

Prevalence of volatile substance use

Gathering accurate estimates of the number of volatile substance users is notoriously difficult. Since VSU is not a criminal activity anywhere in Australia, record keeping is not a uniform or common practice and inhalant use is often a secretive and furtive activity [14]. There are elements, however, of VSU which are highly visible, and are the cause of much alarm in communities, whether large or small [80]. An example of this is when young people chrome or sniff petrol - in view of adults - to reinforce their dissatisfaction or emphasise control over their lives [23].

There are two regular national surveys of drug use: the *National drug strategy household survey* (NDSHS) and the *Australian school students alcohol and drugs (ASSAD) survey*, but each is limited in terms of its ability to provide an accurate estimation of use, particularly when examining VSU among Indigenous and non-Indigenous Australians [81, 82]. The issues of age, Indigenous status, and residence are crucial factors when assessing the accuracy and generalisation of survey data on VSU, and both surveys have deficiencies in all areas.

Data from the 2013 NDSHS indicate that 3.8% of people aged over 14 years had ever used inhalants (Table 2) [81]. Inhalants had been used by 0.8% of the population in the past 12 months and of these, 30% had used them at least once a month or more. Although these data indicate a slight increase from the 2010 NDSHS, where 0.6% of those over 14 had used inhalants in the past 12 months, this was not a statistically significant increase (Table 3). In 2013, significantly more males aged over 14 years had used inhalants in the past year than in 2010 (1.1% vs 0.7%), but there was no significant change for females. The proportion of those who had used in the past 12 months was highest among 20-29 year olds (1.9%). In 2010, however, the highest proportion of those who had ever used inhalants was among those aged 30-34 years (8.2%), followed by those aged 25-29 years (6.4%) [83]. Neither of these surveys, however, breaks down these categories by Indigenous status, remoteness, nor did they interview those who were homeless, institutionalised, or in current treatment [81, 83].

The 2011 ASSAD survey indicates that 17% of those aged over 12 years had ever used inhalants, 13% in the past 12 months, 7% in the past month, and 4.4% in the past week (Table 4). Prevalence rates were higher among those who were younger, with 20% of 12 year olds having ever tried inhalants compared to 11% of 17 year olds [82]. As with the NDSHS, the ASSAD did not examine prevalence data by Indigenous status, and only surveyed students attending school, which for the context of this review and examining VSU among Indigenous people, may lead to inaccurate data.

Table 2. Percentage of people using inhalants, by frequency of use and sex, Australia, 2013

	Sex		Persons
	Male	Female	
Lifetime use	4.7	2.9	3.8
Used in the past 12 months	1.1	0.5	0.8

Source: AIHW, 2014 [81]

Table 3. Percentage of inhalant use among people 14 years and older, by frequency of use and year, Australia, 1993 to 2013

	1993	1995	1998	2001	2004	2007	2010	2013
Lifetime use	3.7	2.4	3.9	2.6	2.5	3.1	3.8	3.8
Used in the past 12 months	0.6	0.4	0.9	0.4	0.4	0.4	0.6	0.8

Source: AIHW, 2014 [81]

Table 4. Percentage of 12-17 year old school students using inhalants, by frequency of use, age and sex, Australia, 2012

	Age (years)						Total
	12	13	14	15	16	17	
Never used							
Males	82.7	81.4	82.8	83.4	84.7	88.6	83.7
Females	77.1	77.0	79.9	82.0	87.5	89.4	81.8
Total	79.9	79.2	81.3	82.7	86.1	89.0	82.7
Ever used							
Males	17.3	18.6	17.2	16.6	15.3	11.4	16.3
Females	22.9	23.0	20.1	18.0	12.5	10.6	18.2
Total	20.1	20.8	18.7	17.3	13.9	11.0	17.3
Used in the past 12 months							
Males	13.2	13.5	12.2	11.5	9.7	7.4	11.5
Females	17.2	18.4	15.7	13.2	8.7	6.6	13.6
Total	15.2	16.0	13.9	12.4	9.2	7.0	12.6
Used in the past month							
Males	8.4	7.6	6.7	5.5	4.8	3.7	6.3
Females	11.1	11.0	8.1	7.8	3.9	3.6	7.8
Total	9.8	9.3	7.4	6.7	4.4	3.6	7.0
Used in the past week							
Males	6.0	4.6	4.3	3.5	2.9	2.4	4.0
Females	6.5	6.9	5.5	4.7	2.4	1.8	4.8
Total	6.2	5.7	4.9	4.1	2.6	2.1	4.4

Source: White and Hayman, 2012 [82]

Prevalence of petrol sniffing

Although not widespread or routinely collected, there is some Australian prevalence data available on Indigenous VSU. In 1985 it was estimated that 9.4% of communities in the NT (35 out of 371) had experienced problems with petrol sniffing [7]. At this time VSU was predominantly confined to Aboriginal and Torres Strait Islander communities in Arnhem Land and Central Australia [62]. By the late 1990s, however, petrol sniffing was being reported in previously unaffected communities, including the Katherine region of the NT, Cape York in Queensland (Qld), south-west Qld, western New South Wales (NSW) and northern Victoria (Vic). In a 1997 study conducted in Alice Springs, it was estimated that there were 60 inhalant users, most of whom were sniffing paint [84]. In 2004 approximately 30 communities in the NT were still experiencing problems with petrol sniffing, with an estimated 350 chronic, persistent sniffers [8]. In 2006, there were approximately 600 chronic petrol sniffers across Central Australia [9], 75 of whom were thought to be residing in or visiting the Alice Springs town camps [85]. A more thorough survey of petrol sniffing conducted during 2006-2007 in remote Indigenous communities that had introduced low aromatic fuel found that just over 1,000 people

were currently sniffing in these communities, representing 4.8% of the population aged between 5 and 40 years [86].

A 2008 estimate of the petrol sniffing population across the primary sniffing areas, undertaken as part of a low aromatic fuel cost-benefit analysis, indicated that there were 1,722 petrol sniffers, and a sniffing rate of 3% of the population in the area [69]. Remote Indigenous communities included in the 'analysis zone' are listed in Table 5, but also included urban areas in the Top End of the NT, the gulf area of Qld and the area in South Australia (SA) and Western Australia (WA) along the Great Australian Bight. As the study focused on geographical areas where maximum benefit could be achieved, VSU in Darwin was not included.

A follow-up estimate of petrol sniffing is currently being undertaken in some of the same communities as the 2008 study, in order to monitor the ongoing effects of substituting low aromatic Opal fuel for regular fuel. Preliminary findings from this analysis indicate that there are 276 current petrol sniffers, primarily located in four of the nine regions in which the communities have been selected [11]. Remote Indigenous regions included in the analysis are listed in Table 5. Out of the 41 communities included in the current analysis,

Table 5. Numbers of petrol sniffers in 15 communities, by region, 2005-2012

Region	Number of communities	Number of sniffers 2005-07	Number of sniffers 2008	Number of sniffers 2011-12
Cape York (Qld)	1	42	0	0
Gulf (Qld)	2	46	24	17
South Australia	3	123	29	10
Goldfields (WA)	3	122	30	51
Central Australia (NT)	2	66	8	2
Top End (NT)	3	115	20	16
Kimberley (WA)	1	32	49	1
Total	15	546	160	97

Source: d'Abbs and Shaw, 2013 [11]

Table 6. Numbers of sniffers in 15 communities by age group, and year, Australia, 2005-2012

Age group (years)	2005-7	2008	2011-12
5-9	14	12	0
10-14	88	77	24
15-24	330	62	69
25+	114	9	4
All ages	546	160	97

Source: d'Abbs and Shaw, 2013 [11]

15 have comparable data from 2005 and 2007-2008. Comparable data indicate that although the total number of current sniffers has declined, from 546 to 160 to 97 respectively, this has not been uniform (Table 6). In communities located in the Goldfields region of WA, the number of sniffers has increased from 30 in 2008 to 51 in 2011-12 [11].

Problems associated with volatile substance use

In regards to the individual volatile substance user, a study of petrol sniffing among the Pitjantjatjara people SA found that many chronic sniffers were socially isolated, living apart from their families, and/or in gangs that were responsible for much community crime [87]. Consequences of VSU are not confined to the user, but also affect the families, communities, and the wider society [2, 86]. The problems experienced at these four levels are detailed in Table 7. Not all problems are experienced in all cases and they may be co-occurring rather than being caused by VSU.

Affected families often feel a sense of shame and a lack of control over their youth, in addition to emotional and financial hardships they may already be suffering. Although parents may feel helpless to stop VSU, they may also be responsible for caring for an increasingly debilitated child [86]. VSU can create intense disruption which is

disproportionate to the number of users. Property crime, violence, family friction, physical and mental health problems and young people committing suicide often accompany VSU [14]. Constantly coping with these problems debilitates a community, which can hamper its ability to function cohesively [8]. VSU also affects the wider Australian community in terms of decreasing productivity, and the necessity of interventions by various government services. In 2005, the estimated total annual cost of petrol sniffing in Central Australia was \$78.9 million, which included the following major component costs:

- \$38.1 million cost of burden of disease
- \$16.2 million crime and judicial costs
- \$8.3 million loss of productivity
- \$4.2 million long-term care
- \$4.1 million health care
- \$3.7 million rehabilitation [88].

Table 7. Key problems associated with volatile substance use

Those experiencing	Problems
Volatile substance users	acute physiological and toxicological consequences including: intoxication; hallucinations; irrationality; aggression; disinhibition; confusion; lack of coordination; blurred vision; headaches; poor memory; slurred speech; vomiting
	chronic physiological and toxicological consequences including: neurological injury; cognitive impairment; vision, hearing and movement impairment; heart, lungs, liver and kidney damage
	effects on foetus if VSU occurs during pregnancy
	poor school attendance and performance
	less opportunity to learn cultural knowledge
	alienation from family and community
	social stigma
	increased likelihood of homelessness, involvement with the criminal justice system, and future drug use
	death
	Families of volatile substance users
worry, grief and stress of caring for family members disabled by use	
threat of violence	
Local community	inter-familial conflict and blaming
	damage to property
	disregard for Indigenous and non-Indigenous authority, associated social disruption
	loss of young people contributing to the community
Wider society	demands on health care system
	long-term care for those disabled by use
	demands on criminal justice system

Source: Adapted from d’Abbs and MacLean, 2008 [14]

Over \$80 million has been spent by the Commonwealth on initiatives as a part of the *Petrol sniffing strategy (PSS)* since 2004-05, of which \$42 million has been spent on low aromatic fuel (LAF) [10]. Other programs and funding sources that have contributed to support petrol sniffing programs, targeting the underlying causes of VSU, amount to an estimated \$213 million since 2004 [10].

A cost-benefit study of mandating LAF use calculated the long-term costs of sniffing within the ‘analysis zone’ of major sniffing areas (excluding Darwin) in 2010 [69]. At that time, current value terms of the 25-year cost of petrol sniffing in these locations was calculated at \$1,708 million. Of this, \$1,014 million was the cost to sniffers, primarily in the form of morbidity, mortality, and loss of earnings. The other costs were attributed as costs to government (\$471 million), and costs to the communities in which sniffers live (\$223 million).

Morbidity and mortality

There is no current systematic collection of VSU-associated mortality or morbidity data in Australia at the state, territory or national level [14]. Volatile substance users typically present to

health services with illnesses or injuries caused by VSU, but the record only reflects the presenting problem. Similarly in the case of deaths, the practice is to list the medical explanation rather than the use of volatile substances that may have led to it [51]. For example, the cause of death of a chronic petrol sniffer may be recorded as asphyxiation, car accident or suicide, rather than the petrol sniffing that precipitated the renal failure.

Some state-wide data can be used to estimate the morbidity and mortality associated with VSU. Victorian data collected on drug use and harm in 2003-04 indicated that VSU was the main presenting drug problem in 1.5% (726) of clients undertaking courses of treatment delivered by specialist alcohol and drug services [89]. In the same year, 35 VSU related hospitalisations resulted in 214 bed stays. In WA, between 1994 and 2000, there was an average of 32 VSU related hospital admissions per year [1].

Another way of calculating Indigenous hospital admissions attributable to petrol sniffing is through the aetiological fraction methodology [69]. This uses epidemiological studies to determine the proportion of a health condition attributable to various risk factors. Petrol sniffing is a risk factor in the following Australian Refined Diagnosis Related

Groups (AR-DRG) codes, which provides information on the diagnosis/ intervention for that hospital admission:

- C91 lymphoid leukaemia
- C92 myeloid leukaemia
- F18 mental and behavioural disorders due to the use of volatile solvents
- T52 toxic effects of organic solvents
- G92 toxic encephalopathy
- X46 accidental poisoning by and exposure to organic solvents and halogenated hydrocarbons and their vapours.

When the relevant aetiological fractions are applied to the 282 Indigenous admissions in 2007-08 for these six conditions, 77.4 (27%) can be attributed wholly to petrol sniffing [69].

A national study indicated there were 121 deaths from VSU between 1980 and 1987, 17 of which were attributable to petrol sniffing [90]. At this time petrol contained lead, suggesting an increased likelihood of cumulative neurological damage and death. More recently, mortality data have been collected in Victoria [51]. Coronial files indicated that between 1991 and 2000, 44 deaths

were associated with VSU. Neither of these reports has published information related to Indigenous status.

There is more information available at a regional level on mortality associated with petrol sniffing, and in all cases those who died were Indigenous [14, 66]. Coronial and other evidence were used to estimate that 63 Indigenous people died from causes related to petrol sniffing between 1981 and 1991: two-thirds were from desert communities that straddled the border region of WA and SA [66]; 12 were from communities in the Goldfields region of WA; and nine deaths occurred in the Central and Top End of the NT. Only three of those who died were female. More recent research using a combination of coronial and government reports, community death registers and personal communications identified 37 petrol sniffing deaths between 1998 and 2003. The geographic distribution of these deaths is provided in Table 8.

Compared with the 1981-91 data, there was a decrease in deaths in the desert regions of WA and SA, and in the Goldfields region of WA, but deaths increased in the central area of the NT and in the East Kimberley region of WA [14, 66]. The immediate causes of these petrol sniffing deaths are listed in Table 9.

Table 8. Numbers of deaths from petrol sniffing, by region, 1998-2003

Region	Number of deaths
Ngaanyatjarra Lands	5
Pitjantjatjara Lands	11
Central Northern Territory	16
East Kimberley	3
Top End	2

Source: Shaw et al., 2004 [66]

Table 9. Numbers of deaths and immediate causes of death attributed to petrol sniffing, Australia, 1998-2003

Reported cause of death	Number of deaths
Respiratory failure / asphyxia	10
Homicide	3
Cumulative impact of sniffing	3
Chronic obstructive airways disease	2
Burns	1
Suicide	9
Cardiac arrest	2
Motor vehicle accident	4
Fall from height	1
Lost in bush	1
Not reported	1

Source: The South Australian Centre for Economic Studies, 2010 [69]

Responding to volatile substance use in Aboriginal and Torres Strait Islander communities

Supply reduction

Supply reduction strategies tackle the external availability of volatile substances by addressing the accessibility, affordability and availability of the substances. There are four supply reduction methods designed to address VSU: product modification strategies; restriction of physical access to substances; mandatory sales restrictions; and voluntary sales restrictions [14].

Product modification

There have been various strategies that have attempted to deter VSU by modifying the substances, including modifying packaging to restrict use, adding deterrent chemicals, and replacing or removing the toxic or psychoactive components to reduce the harms associated with their use. Modifying the packaging of volatile substances to deter their use for intoxication has little support in the literature [14]. Modifying the nozzles of aerosol cans was trialled in the UK, but determined users were able to access the propellants by puncturing the can or by removing the nozzle [51].

The addition of deterrent chemicals to substances is a viable option when it cannot be sidestepped, and does not adversely affect legitimate users of the product. Four Indigenous communities added ethyl mercaptan to petrol. It has a strong offensive odour, and causes nausea and vomiting when inhaled. The strategy on the whole was unsuccessful: in one community, residents objected to the smell; in the second, parents became distressed by children vomiting; in the third, there was little community support for the intervention; and in the fourth, chronic sniffers were able to continue sniffing after discovering that the ethyl mercaptan would evaporate if the petrol was left in the open [66, 71].

The most effective product modification strategy has been the replacement of harmful and psychoactive chemicals with more benign alternatives [91]. Research in the UK has indicated that reducing the intoxicating components through product reformulation has been associated with reduced VSU-related deaths [92]. In Australia, leaded petrol was nationally phased out on 1 January 2002, due to the health risks [93]. Although the more widespread use of unleaded petrol did not reduce petrol sniffing, it did affect the associated levels of morbidity, with unleaded petrol sniffers not requiring hospitalisation for lead encephalopathy or seizures [66].

Introduction of reduced-toxicity spray paints

The introduction of reduced-toxicity spray paints was initially driven by a desire on the part of industry to reduce the negative impact of aerosol propellants on the environment, which inadvertently resulted in a product that produced fewer aromatic hydrocarbons and little intoxication when inhaled [94, 95]. Several manufacturers have modified spray paints in this way, including White Knight, Dulux, Plasti-kote, Motor Tech and Export. They have been available in Australia since 2004 [95].

Reduced-toxicity spray paints have removed toluene and xylene from the propellant and lead from the paint, which has eliminated the intoxicating effects associated with chroming. The paints are lead-free, produced in recyclable cans, and do not contribute any CFC damage to the ozone layer [95]. Further, their rollout has been associated with a decline in 'suspicious' sales at Alice Springs retail outlets [96].

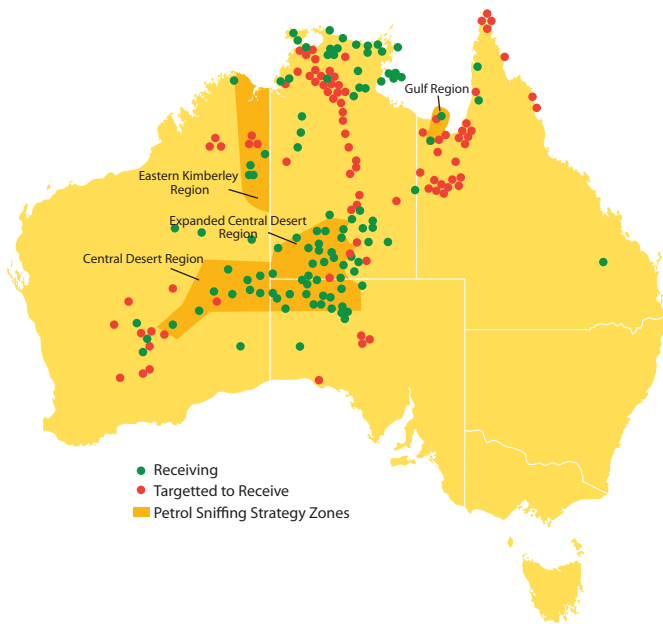
Introduction of low aromatic fuel

From 1998 until 2005 through the Federal Government's COMGAS scheme, Aviation Fuel (Avgas) was subsidised to be used in remote communities in WA, SA and the NT. Avgas contained fewer hydrocarbons and produced less of a euphoric effect than leaded or unleaded petrol [88]. It was available in 36 communities by the end of 2004 [88]. The inhalation of Avgas caused severe headaches and stomach pains due to high quantities of tetraethyl lead present, and this further inhibited sniffing [88, 97].

By 2005, changes in the formulation requirements for aviation fuel meant Avgas would no longer be suitable to use as a deterrent to petrol sniffing and this led to the development of LAF as a replacement for Avgas. LAF production and distribution was subsidised by the Federal Government, and in 2006 it was the most commonly used unleaded fuel across Central Australia [88, 98].

The provision of LAF rapidly expanded until 2007-08 and then stabilised. As of 2012, LAF was being delivered to 123 sites throughout Australia, although consumption has declined slightly since 2008-09 [10] (Figure 1; Figure 2). Following the introduction of LAF, there has been a substantial reduction in petrol sniffing across Central Australia, which has largely been attributed to its rollout [11, 14, 99]. The initial rollout and use of LAF was associated with various difficulties, however, which may have had broader implications for its long-term success (e.g. poor communication at the time of the initial rollout, leading to the circulation of false information about LAF's effect on cars [5]).

Figure 1. LAF delivery sites at February 2012



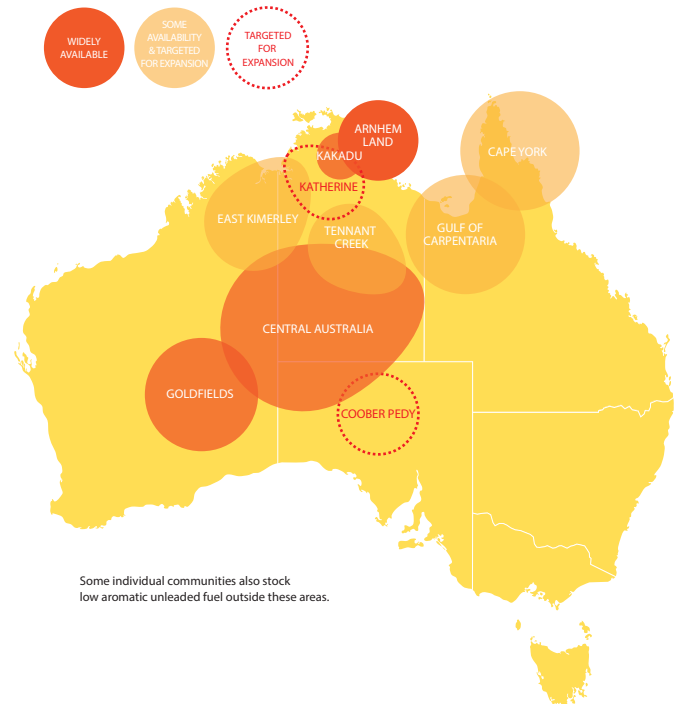
Source: Marcus and Shaw, 2013 [10]

Following the initial introduction of LAF in 2005, the Australian Government expanded its commitment to preventing petrol sniffing through an 'Eight point plan', by enlisting the support of the WA, SA and NT governments. The *Eight point plan* later became the basis of the *Petrol sniffing strategy* (PSS), and was a coordinated and comprehensive approach to addressing petrol sniffing, targeting the cause as well as the practice of sniffing [10]. The eight points were:

1. consistent legislation with penalties for offences relating to the sale or supply of volatile substances for sniffing
2. appropriate levels of policing
3. further roll-out of LAF
4. development of diversionary activities for young people
5. provision of treatment and respite facilities
6. development of communication and education strategies
7. strengthening and supporting communities
8. evaluating interventions.

Broadly, the PSS aimed to reduce the incidence and prevalence of petrol sniffing within the PSS zones (Figure 3) by addressing the complex interplay of contributing factors: reducing the impact of sniffing on individuals, families and communities in the PSS zones; evaluating the effectiveness of a comprehensive response to petrol sniffing; and determining whether it can be usefully adapted in other regions [10].

Figure 2. Availability of LAF



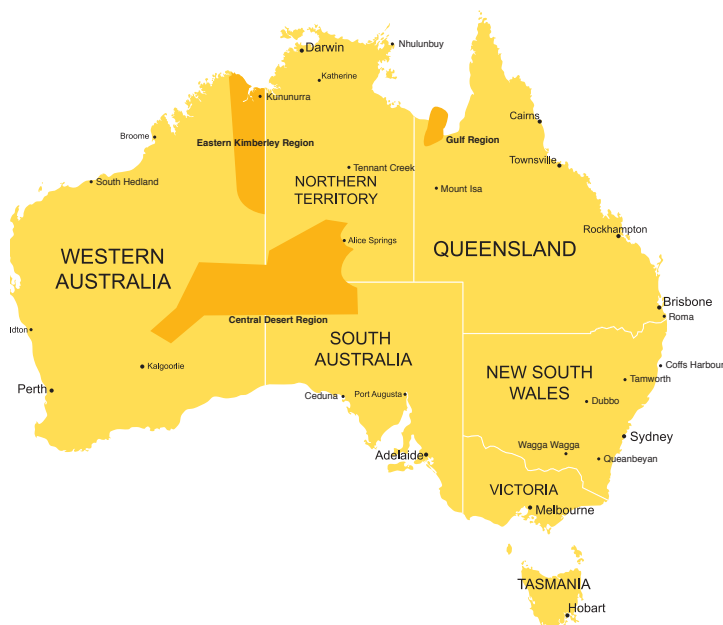
Source: Department of the Prime Minister and Cabinet, 2015 [100]

Although LAF was initially delivered only to communities located within the PSS zones (Figure 2), LAF has been provided to communities outside the zones for several years. These areas are known as the 'LAF footprint', and their creation was driven by the recognition that petrol sniffing occurred outside the PSS zones, and that for some areas, the access to regular unleaded petrol from areas outside the zone affects the availability of regular petrol, and thus the levels of sniffing inside the zones [10].

Although the initial development and production of LAF was supported by BP Australia Pty Ltd, the Australian Government announced in December 2012 that Shell Australia would commence production of LAF starting in late 2013. BP would supply LAF to Central and South Australia, and parts of WA, while Shell would be the primary supplier of LAF to the Top End, the Gulf of Carpentaria, Cape York and East Kimberley [12].

The substitution of unleaded fuel with LAF relies on petrol stations and roadhouses voluntarily replacing their unleaded fuel with LAF. Since the rollout of LAF, however, there has been contention about whether the stocking of LAF should be mandated by governments, particularly in 'strategically located retailers' that refuse to stock it [4, 10]. A 2010 cost-benefit analysis of legislation to mandate the supply of LAF in regions of Central Australia concluded that the Opal rollout had greatly contributed to a substantial reduction in sniffing and that the community benefits of mandating LAF supply would outweigh the costs. The study also identified a need for fuel storage and distribution practices to be addressed to allow for a more comprehensive rollout of LAF [69].

Figure 3. Map of petrol sniffing strategy zones



Source: FaHCSIA, 18 Oct 2012, [cited in 10]

The 2013 *Evaluation of the PSS* [10] reported that the Australian Government indicated they would support legislation to mandate the supply of LAF in certain areas, allowing the Minister to designate specific areas as 'fuel control areas,' or 'low aromatic fuel areas.' In the former, the supply and storage of other petrol, including premium unleaded, would be restricted, and in the latter, only LAF would be available [10]. The 2013 *Evaluation of the PSS* suggested that the geographic scope of the LAF would likely expand, highlighting the need for robust consultation between agencies for the coordinated delivery of services that complement and reinforce the impact of LAF [10]. Further, the lack of storage facilities for LAF in northern Australia was associated with problematic petrol sniffing across the Top End of the NT [10], limiting the complete rollout of LAF [69]. In January 2014 it was announced that a storage tank for LAF would be constructed in Darwin, supporting the expanded rollout of the *Petrol sniffing prevention program* (PSPP) across the Top End [101]. The tank was completed and launched in February 2015 [102].

Although LAF has largely replaced standard unleaded fuel in Alice Springs and across Central Australia, aromatic premium fuel is still available in Alice Springs and at some roadhouses. In 2008, it was estimated that the use of premium unleaded fuel usage grew from 10% prior to the introduction of LAF to 50% [80], which may point to community suspicion towards LAF [4]. Alternatively, it is possible that the high turnover of tourist population in places such as Alice Springs, who are unfamiliar with LAF and its purpose, may contribute to the increase in usage of premium unleaded. It may

also be in part due to the necessity of high performance cars and vehicles manufactured prior to 1986 requiring premium unleaded, for which there is no low-toxic or aromatic alternative [4].

In 2009, a Senate Inquiry into the impact of LAF recommended that, should the retailer guidelines for selling premium unleaded fuel be ineffective, serious consideration be given to a government subsidised low-aromatic premium fuel equivalent [4]. In response, however, the Government indicated that development of a low-aromatic premium fuel was not being considered, and information presented by BP Australia suggested the low volume of premium sold within the 'designated petrol sniffing zones' would require a heavy Government subsidy, considerably higher than that required by LAF [3].

The impact of LAF, however, is undeniable. A 2008 evaluation found a 94% reduction in petrol sniffing across Central Australia following the rollout of LAF [99]. The study found a statistically significant relationship between community distance to an unleaded fuel source and the size of the decline in sniffing in communities, which pointed to the significance of LAF in the reduction of sniffing [99].

Although the rollout of LAF has had a critical impact on petrol sniffing in major areas across Australia, the substitution is only one element in addressing substance use [4], and is not an absolute solution to the problem. Rather, LAF needs to be implemented in conjunction with a range of strategies which address causal factors such as underlying social and educational disadvantage [5]. The lack of coordination between the introduction of LAF in some areas and access to youth or community services means that demand reduction or diversionary strategies have not always been delivered to reinforce or complement the impact of LAF [10, 99].

Restricting physical access to volatile substances

The difficulty in controlling VSU is that volatile substances are not illegal or illicit, and provide an important function to the majority of the population. Prohibiting the use of volatile substances is therefore not a viable or practical policy option, however, tighter regulation and control of some volatile substances is possible.

The strategy of physically preventing access to substances has been attempted in almost every location where petrol sniffing has been a problem [14]. These strategies have included enclosing petrol pumps with cages, employing guard dogs, and floodlighting petrol stations and other petrol housing facilities, however, none have proved completely effective [66, 71]. In some communities, volatile substance users have broken into the petrol tanks of cars and other motor vehicles, or have cut the fuel lines that surround petrol stations, demonstrating how users are forced into finding alternative access to substances under this strategy [66].

The failure of these approaches to completely eradicate VSU does not mean that substances should be left unsecured, but rather, that restriction of access is not effective when used in isolation [14].

Mandatory restrictions on sales

Although the benefit of legislating to restrict sales of volatile substances has not been clearly demonstrated, evidence suggests that restricting volatile substance availability has resulted in decreased use [69, 99]. Previous evidence from the UK documented that when legislation was introduced to restrict the sale of certain glues, users switched to more dangerous products, such as butane and aerosols [103]. Other evidence, however, has documented that restricting sales of lighter refills to those under 18 years reduces mortality in this age group [92].

The majority of Australian jurisdictions have legislation that prohibits the sale or supply of volatile substances to a person who can be reasonably expected to use them as an intoxicant. In 2013, the Federal *Low aromatic fuel act* was introduced, which placed further restrictions on the transport and supply of volatile substances, particularly within designated low aromatic fuel areas and fuel control areas (see Legislation section of this review). There have been difficulties, however, in enforcing this type of legislation. The decision-making of some retailers has been driven by concerns that refusing sales to Indigenous people could be misconstrued as racial discrimination and could leave them vulnerable to charges [104]. Other states have restricted the sale of volatile substances to individuals aged under 18 years [14] - in SA, it is illegal to sell spray paints and wide-tip markers to those aged under 18 years, and they must be stored in locked cabinets. The sale of petrol is also prohibited to those less than 16 years of age. Further, as of 2007, South Australian retailers must keep a register of volatile product sales. NSW and Qld have also restricted the sale of spray paints to those aged less than 18 years.

Voluntary restrictions on sales

Several local programs have attempted to reduce supply through voluntary agreements with retailers [104, 105]. Despite the scarcity of evaluations, the limited evidence available suggests that convincing retailers to lock up volatile substances and usable products, such as spray paints, markers and glues, and refuse sales to those suspected of misusing the substance, has been effective when introduced through a process involving community development and retailer education [96]. An Alice Springs retailer education network is an example of this approach, in which a supply reduction officer visited all retailers in Alice Springs that stocked and sold volatile substances. Retail staff or store managers were asked to stock substances securely, and advised of legislation that made it an offence to knowingly supply volatile substances to

those who will use them [96, 105, 106]. Rather than visiting retailers in a once-off intervention, the retailer network is an ongoing program, and is likely to be an ongoing effective strategy with opportunistic users.

Legislation

Under the *Eight point plan*, there was a move towards developing consistent legislation for addressing VSU across all Australian jurisdictions, though the purpose was never clearly understood [10]. A uniform legal framework would recognise the importance of law enforcement in responding to VSU, and provide the assistance of legal mechanisms for families and communities to help young people stop sniffing without criminal penalties. Further in the NT the introduction of the *Volatile substance abuse prevention act* (NTVSAPA) 2005 aimed to provide police and service providers with specific powers and responsibilities when faced with the use of readily accessible substances, and may have served as an impetus for the drive for legislative consistency [10].

Legislation across Australia varies between jurisdictions. A recent 'desktop analysis' conducted in 2008 examined different legislative approaches adopted by states and territories to legislate petrol sniffing and VSU. Specifically, it addressed:

- definition of volatile substances
- whether inhaling or possessing volatile substances is an offence
- offences of sale or supply of petrol and volatile substances
- police powers and reporting requirements
- involuntary treatment of chronic substance users
- involvement of Aboriginal communities in the management of sniffing [10].

A second study conducted in 2010 examined existing legislation relating to petrol sniffing in jurisdictions where the PSS was being implemented - WA, SA, NT and Qld [10] - to examine the effectiveness of different legal frameworks across jurisdictions. The study found that:

- there were no adverse impacts from discrepancies in existing frameworks that need addressing by the introduction of consistent legislation
- although the vast majority of stakeholders were satisfied with the legislative tools available to them, jurisdictions were not mandating people into treatment because of the lack of available services to which petrol sniffers could be sent
- stakeholders recognised the necessity of legislative frameworks as fundamental tools in the response to VSU
- stakeholders identified two main factors as critical to the success and sustained reduction of VSU in communities:

- strategies to reduce the supply of volatile substances
- access to good quality services such as rehabilitation and diversionary programs [107].

Although achieving legislative uniformity was not found to be a major priority, there has been some confusion surrounding VSU legislation. Specifically, confusion about the legal framework, and differing opinions about the ability of police to intervene; no clear definition of treatment or respite services to which volatile substance users can be mandated in addition to a lack of resources; and confusion or perceived inability of community services or police to intervene when people are known to be misusing volatile substances, but not break any law [10, 107].

The NTVSAPA, which is one of the most comprehensive legislative responses addressing VSU, had four primary components:

1. the prevention of substance use
2. assessments and treatment orders for those considered to be at risk of severe harm
3. community management areas controlling the possession, supply and use of volatile substances
4. the criminalisation of supplying volatile substances [69].

Community management plans allow communities to control the possession, supply and use of volatile substance within a designated space within communities [69]. Once approved by the Minister, communities can prohibit petrol and paint from entering into the community. This is legally enforceable by police. In this way, communities can manage their own sales of petrol and other volatile substances, similar to alcohol 'dry' areas. Only community members are able to request and endorse community plans, and amending plans requires a minimum of ten community residents.

The Low aromatic fuel act 2013

As of 14 February 2013, new Commonwealth legislation has been in place to target the supply of LAF and control the supply of other fuel within certain areas. This legislation, known as the *Low aromatic fuel act 2013*, allows the Australian Government to mandate the availability of regular unleaded petrol (for example in cases where there is a risk of petrol sniffing and a retailer refuses to stock LAF).

In practice, this is achieved by the relevant Minister designating 'low aromatic fuel areas' or 'fuel control areas', with specific rules regulating the supply, transport and possession of petrol within those areas. Low aromatic fuel areas and fuel control areas can only be designated by the Minister of Health after consultation with stakeholder groups, including community members, local organisations, health experts, the fuel industry and state and territory governments. Within low aromatic and fuel control areas, restrictions can be made in regards to:

- prohibiting the sale of regular unleaded petrol
- promoting and monitoring the supply of LAF
- regulating the supply and storage of other fuels, in particular premium unleaded petrol [12].

Once restrictions under the *Low aromatic fuel act* are put in place, it is an offence to contravene them, but they only apply to businesses registered as corporations. As such, they do not apply to people travelling through a low aromatic or fuel control area [12].

While the introduction of the *Low aromatic fuel act 2013* has the potential to address concerns that have continually been presented by petrol stations refusing to stock LAF, and volatile substance users obtaining access to premium unleaded petrol for the purposes of sniffing, to date there have been no low aromatic or fuel control areas designated under the legislation by the Minister. It remains to be seen whether this legislation will be used as a reactive rather than preventative tool to address petrol sniffing, particularly in areas across Central Australia.

Demand reduction

The majority of volatile substances are readily accessible, affordable, available and easy to use. Although reducing the availability and supply of substances is essential in tackling VSU, it is unlikely to be completely effective on its own. Demand reduction strategies, which have the capacity to address the underlying causes of VSU, are also needed. Useful strategies are likely to include a focus on the social determinants of health, such as:

- housing
- education
- employment
- access to services
- social networks
- connection with the land
- racism
- imprisonment rates.

In particular, petrol sniffing can be seen as a result of social deterioration, and its eradication is unlikely to be achieved without long-term commitment to establishing infrastructure in vulnerable communities [108].

Community-based approaches

There is a considerable body of literature on community-based approaches to VSU, in both urban and remote settings. Several of these are summarised below, and more details are provided on some in *Volatile substance misuse: a review of interventions* [14].

Healthy Aboriginal life team (HALT)

The *Healthy Aboriginal life team* (HALT) was an early example of a community-based petrol sniffing prevention program [109]. HALT was based on reciprocity rather than control, and aimed to work with extended Aboriginal families to help them recover their capacity to resolve problems. In the case of petrol sniffers, it sought to reintegrate sniffers with their family systems and to promote the nurturing and controlling capacities of those systems. Counselling and education were used to enable communities and families to redefine petrol sniffing as a problem which could be rectified by families.

HALT had limited success with its original host community of Yuendumu, but when the model was applied throughout the APY Lands it failed to have an impact [110]. This suggested that the orthodox counselling and community development techniques can be effective in reducing petrol sniffing if used with skill, cultural sensitivity and community support, however, the program was not readily transferable to other communities. Other reviews of HALT have expressed concern over its uncritical acceptance of cultural revival as effective prevention, and its reliance on traditional child-rearing practices, which may have discouraged parents from disciplining petrol sniffers [63, 111].

Petrol link-up

Although *Petrol link-up* was a brief project focussing on addressing petrol sniffing in the cross-border region of Central Australia in 1994-1995, it had a widespread and long-lasting impact on petrol sniffing. *Petrol link-up's* primary aim was to support community action addressing petrol sniffing, and share information between communities. The 'three ways' model involved:

- substitution of Avgas for normal petrol
- removal of petrol sniffers to outstations to help 'break' their behaviour and give some respite to communities
- provision of positive alternatives in communities, such as youth and recreational activities and employment [14].

Despite its brief existence, two of these strategies - substitution of petrol with Avgas, and outstation programs – have formed part of the critical response to petrol sniffing in Australia [14].

The Central Australian youth link up service (CAYLUS)

The *Central Australian youth link up service* (CAYLUS) is an Alice Springs based program that was established in 2002. CAYLUS was instrumental in the initial rollout of LAF across Central Australia, campaigning for LAF on behalf of communities. CAYLUS achieved this by fostering relationships with government and convincing them that LAF was a viable and mechanically safe alternative to unleaded fuel in Alice Springs and remote areas. CAYLUS provided

the link between communities, other agencies, local organisations and government, and assisted communities to write letters campaigning for LAF [106].

Although based in Alice Springs, CAYLUS supports up to 19 remote communities and the youth workers located within them in the Central Australian region. CAYLUS's main approach to VSU focuses on:

- supply reduction measures:
 - monitors which retailers are selling volatile substances
 - networks directly with retailers to ensure volatile substances are secure
- demand reduction measures:
 - appoints and supports youth workers in remote communities
 - assists remote communities in the development, funding and implementation of youth and recreation programs
- individual and family casework:
 - monitors the local progress of volatile substance users and those who may be at risk
 - provides individual and family assistance to those who need it.

CAYLUS's approach to VSU and risky behaviours is holistic, and emphasises the need for community support, connections and empowerment. CAYLUS encourages communities to play active roles in the response to VSU [96, 106, 112]. In a recent qualitative evaluation of CAYLUS, the majority (75%) of community members interviewed rated the quality of youth worker programs provided by CAYLUS as good or excellent, with skilled workers that genuinely care about young people [113]. This evaluation was conducted in seven communities in which CAYLUS supports youth programs.

Makin' tracks

Makin' tracks was a South Australian based program designed to address VSU in selected remote communities [114]. This involved a team of two educators travelling in mobile units to communities and organisations. The educators assisted with the development of strategies to address the harms of petrol sniffing, alcohol or other drug use. Since the program's implementation in 1999, there have been three formal program evaluations which not only emphasised the continuing need for the program, but also identified strengths of the program that could potentially be useful for other substance use programs:

- employment of well-trained staff
- provision of continuous support for isolated workers
- flexibility of the staff and program in their ability to adapt the program to suit the needs of each community

- establishment of positive relationships between project workers and young people at risk
- provision of training, support and resources for community workers
- clearly defined project objectives and performance indicators
- awareness of Aboriginal cultures and broader implications for the project [114-116].

These elements were critical to the success of the *Makin' tracks* program, which delivered training designed specifically for each community, depending on their particular needs [117]. Despite the program's considerable impact since implementation [114-116], funding was ceased in July 2014.

Cairns inhalant action group

The *Cairns inhalant action group* (CIAG) is an urban program focused on VSU among Aboriginal and Torres Strait Islander young people, which was formed in 2002 in response to an increase in local inhalant use [118]. The group was coordinated by Wuchopperen Health Service, an Aboriginal and Torres Strait Islander community controlled health service in Cairns. Participants included the Cairns City Council, Queensland Police Service, government and non-government agencies [118]. A project officer was employed to coordinate responses to VSU. The CIAG implemented the following prevention strategies:

- working with retailers to restrict the supply of products
- providing staff development education in agencies dealing with issues arising from VSU
- facilitating interagency case management of known users
- developing an information card and other resources
- conducting needs assessments among service providers and users
- monitoring of changes in prevalence of VSU
- providing education and support for communities and families about responding to VSU
- advocating for the improvement of service responses for people who use volatile substances.

Since the inception of CIAG, VSU in Cairns has substantially reduced, to the point where the group reduced its meetings from monthly to biannual [119].

Community patrols

Community patrols, commonly referred to as night or day patrols, operate in several communities; community members watch out for each other and prevent substance users from inhaling or sniffing, usually by returning them to their families [66, 120]. They were first developed as a response to the 1991 *Royal commission*

into Aboriginal deaths in custody, and were originally operated by the Aboriginal and Torres Strait Islander Commission.

Community patrols are designed to intervene when Aboriginal people are in danger of becoming involved with the criminal justice system, or when they are at risk of dangers from alcohol or other drugs, violence or other risky behaviours. Patrols can:

- improve the community environment
- increase positive public responses
- improve attitudes towards the police
- empower and strengthen the community [121].

Successful patrols operate independently from, but in close collaboration with, the police and with their support [122].

Successful patrols have remained community controlled organisations, functioning independently of police, but in close collaboration [123]. Their success is mainly attributed to having:

- high levels of community ownership and drive
- volunteer staff members
- extensive community consultation at program outset
- duties of patrollers that are well defined
- a strong management structure in place [54, 67].

Although community patrols are critical in terms of empowering communities and often have widespread community support [124], they have faced problems within some communities arising from cultural authority in terms of Aboriginal kinship and family obligations.

Critical elements for successful community programs

A number of community-based programs have targeted VSU and petrol sniffing in both remote and urban areas with varying levels of success [125]. All however, have contributed to a better understanding of what elements are needed in successful community programs. The following three elements were identified as essential in community programs that are successful in dealing with VSU in Indigenous communities:

- programs need enthusiastic support from non-Indigenous agencies, such as the council, school, and police.
- broad community and family support is needed, along with active involvement in roles such as becoming wardens, taking children to outstations and teaching them about their culture.
- several strategies should be implemented as part of any one campaign [125].

Although community resolve and determination to combat petrol sniffing and VSU is critical, it may not be sufficient alone to develop effective and sustainable interventions [126]. Elements

of community-based support have been incorporated into the NTVSAPA 2005. This has allowed communities to designate community management plans. These plans allow remote communities an element of control over their communities and policing practices. They enable individual communities to ban petrol and paint, and to control the supply and sale of petrol and paint within their council area [85]. Once approved by the NT Ministry, community management plans become legally enforceable by the police.

Strong communities are an essential component in the response to VSU [14, 127], with evidence pointing to the need to promote community capacity building alongside service provision [14].

Drug education and volatile substance use management

Drug education and VSU management strategies aim to prevent the commencement of VSU, help users quit, assist with safe use practices of people who choose to continue misusing volatile substances, and provide health care workers with the necessary resources to effectively manage VSU [128].

Current approaches to community education about VSU include programs targeting communities, universal drug education programs, strategies targeted towards those at-risk of VSU, and those who have used or are using volatile substances [14, 128]. Specific methods include school and peer education workshops or programs, fact sheets, posters, community radio and newspapers, mentoring programs and therapy [128].

Although education programs targeted towards those who may be at-risk of potentially engaging in VSU can be effective in communicating risk-related information, there have been concerns raised by healthcare workers and community members that the provision of VSU information could lead to young people experimenting with these substances [14, 128]. The underlying assumption of restricting VSU education in schools is that students are unaware of their potential to be misused. In contrast, evidence from the UK indicates that three-quarters of 11-14 year olds are aware of inhalants and sniffing [51]. It is unclear what proportion of young Australians are aware of VSU, and there is a general lack of information available to young people in schools and the media about the potential misuse. This could potentially lead to misinformation.

Others suggest that education and harm-reduction information be provided to those known to be at the greatest risk of VSU, or whose peers are known to be using volatile substances. This may be particularly pertinent when communities experience clusters of VSU [129], which necessitates an immediate response, including education and information for the community [128].

The concern that the provision of VSU information to young people could draw attention to the practice and lead to experimentation is reflected in Australian national and state school education policies and strategies, which do not include VSU [130, 131]. Although the rationale underlying these policy approaches is argued to be evidence-based [1, 131-134], there is no clear description of, or reference to, the primary research study that underlies these arguments. The only reference to any empirical research in these policy documents is a study originating from New Zealand, which appears to support the Australian behavioural policy position rather than provide any evidentiary support [135].

One Australian VSU education policy developed by the Victorian Department of Education and Training asserts (without providing supporting evidence) that young Victorians have lower rates of VSU and VSU-related mortality than are attributable to other substances, therefore justifying the exclusion of VSU from school-based drug education [131]. However, the 1996 ASSAD survey which was the study conducted immediately prior to the publication of the Victorian resource, found that 24% of Victorian school students reported they had ever deliberately inhaled a volatile substance [136]. Although lower than lifetime prevalence of alcohol (80%), tobacco (65%) and cannabis (35%), this figure was still higher than lifetime prevalence of sedatives (18%), hallucinogens (7%), amphetamines (5%), opiates (3%), cocaine (3%), and ecstasy (3%) [136].

The current approach to school-based education across most Australian states and territories is targeted VSU education, which seeks to provide VSU education to those already using, or those at risk of using, volatile substances. As such, this strategy is focused on reducing or preventing further harms, and delaying first use [130, 137]. The opposite approach is taken in the UK and in parts of the USA where it is included in mainstream drug education. Research originating in the UK in 1994 argued that providing early education to young people about VSU was critical due to widespread awareness and availability of volatile substances [138]. Education and media campaigns were launched in the UK in response to the rising number of deaths of young people attributed to VSU. These campaigns focused on educating parents, via the media and in schools, about the potential misuse of domestic products [51]. Rather than resulting in a rise in VSU, the campaigns were surprisingly successful, and were believed to be responsible for the subsequent halving of mortality rates [92].

The most recent Cochrane reviews focusing on school-based prevention for alcohol or other drug use have found strong evidence for providing evidence-based education in schools [139, 140]. Only two trials were identified by Foxcroft and Tsertsvadze's 2012 Cochrane review, which examined universal prevention

programs within schools [141, 142]. Neither of these demonstrated adverse effects on the use of inhalants among school students [139].

Whether or not to include education about alcohol or other drug use, including VSU, in the school-based setting seems to be a crucial consideration that is receiving increasing attention in the literature, and is the focus of current evidence-based trials. Research into the use of alcohol and other drugs among young people has illustrated that the typical age of initiation is 15-24 years, and early use of substances, including inhalants, is a risk factor for the later development of substance use disorders [143, 144]. Recent research on school-based programs that aim to prevent the use of alcohol and other drugs suggests that reducing risk factors and enhancing protective factors to promote resistance show the most promise for effective prevention [145]. These should be evidence-based, designed in accordance with best-practice research, and introduced during early adolescent years [143, 146]. Ideally, prevention programs should be delivered prior to the initial exposure to alcohol or other drugs, and allow for the provision of knowledge and skills for young people to make responsible decisions regarding substance use [143].

Although there is an increasingly large evidence-base that supports alcohol and other drug education programs in schools [130, 143, 145, 147], until recently, there has been a lack of longitudinal research examining the impact of school-based drug education in Australia [137]. Addressing this critical need, however, is an ongoing randomised controlled trial of a universal prevention Internet-based program, *Climate schools: alcohol and cannabis course*, based on harm minimisation [148-150]. The *Climate schools* program is facilitated over the Internet, which guarantees consistent program delivery, and uses cartoons and engaging storylines to maintain students' interest throughout the program. It is designed to be delivered to students in year 8 (13-14 years of age) before substantial exposure to alcohol or other drug use occurs. The program's effectiveness has been established in a cluster randomised controlled trial across ten schools in Sydney. The results demonstrated that compared to students receiving usual drug education delivered in health class, students receiving the *Climate schools* program showed significant improvements in alcohol and cannabis knowledge after six and 12 months. Further, in terms of changes in behaviour, students who received the intervention demonstrated a reduction in reported:

- frequency of cannabis use after six months
- average weekly alcohol use at the six and 12-month follow-up
- frequency of drinking to excess 12 months after the intervention was delivered [149, 150].

This study is ongoing and will continue to report the longer-term effects of the intervention.

Although the evidence-base surrounding the effectiveness of Aboriginal and Torres Strait Islander VSU prevention programs in schools is in its infancy, programs based on community support and consultation have been developed [147]. An Aboriginal and Torres Strait Islander variation to the *MAKINGtheLINK* program was developed in 2012. It was based on the 2010 *MAKINGtheLINK* program, which was developed by the National Cannabis Prevention and Information Centre (NCPIC) and Orygen Youth Health. The Aboriginal and Torres Strait Islander *MAKINGtheLINK* program sought to promote health seeking in regards to cannabis, alcohol, tobacco and inhalant use. The program was developed in consultation with a reference group of teachers, Aboriginal and Torres Strait Islander Elders and community members, and focus tested on Aboriginal and Torres Strait Islander primary and high school students [147].

Cultural approaches

A number of innovative programs have been developed using Indigenous cultural practices as vehicles for addressing VSU. These programs have used elements of art, storytelling, and restoration of important caring relationships to redefine the problem of petrol sniffing in Indigenous frameworks [98, 151].

The *Sniffing and the brain* flipchart was developed by Cairney and Fitz [151], and is an example of a resource that uses images and stories with identifiable cultural associations to assist health and community workers explain the effects of petrol sniffing on the body to Indigenous audiences. The evaluation of the flipchart found that it was viewed positively by stakeholders. This emphasised that the storytelling format and use of images to explain the effects of petrol sniffing on the brain made it an effective tool of disseminating information [152].

A resource kit, *Petrol sniffing and other solvents*, was published by the Aboriginal Drug and Alcohol Council (ADAC) of SA in 2000 [98]. Evaluation of the resource found that it was most useful to professionals and policy makers working indirectly with communities, and least useful for community members and parents. Evaluators suggested that such resources would be more useful to Indigenous communities if they were designed and engineered specifically for their use, and contained flipcharts and interactive components such as games, videos and a CD in the local language [98].

The dearth of evaluations into cultural interventions makes it difficult to determine their overall effectiveness. Such interventions offer the potential to influence ways in which people think about VSU by harnessing perspectives to be found within Indigenous

culture, as well as reinforcing traditional capacity to deal with the problem through family and community care.

As with general drug education for young people, scare tactics are not effective, and information based on the immediate needs and proprieties of users have been shown to be the most influential [2, 14, 51, 153]. In regards to what constitutes salient information for young Indigenous volatile substance users, interviews with current and reformed petrol sniffers from Maningrida suggested that neurological effects (such as impaired coordination) worried petrol sniffers, particularly when such impairment might interfere with their ability to play sport [2].

Education targeting parents and other forms of parental support can be useful, particularly as those who experimented with VSU in their youth may not understand the consequences of more intensive or longer-term use [154]. Programs for Indigenous parents have not been evaluated in Australia, but education campaigns in Native American communities have been linked with decreasing levels of VSU.

Successful educational and community-based programs have included:

- measures that have avoided stigmatising users
- elements that have promoted the reconnection with culture
- community involvement and active participation
- the provision of alternative educational opportunities
- the development of work skills
- a diverse range of activities
- flexibility to suit local circumstances [9, 14].

Treatment and respite facilities

The evidence base on the treatment and management of VSU is limited, however, that which exists typically emphasises a poor response to traditional substance use treatment approaches [155]. More than 80% of the 550 respondents to a survey of drug treatment practitioners in Canada assessed their volatile substance misusing clients' prospects of recovery as 'poor' or 'very poor'. Nonetheless a recent systematic review of interventions for VSU identified that Indigenous residential programs show promising outcomes [156].

Counselling is the form of treatment usually provided by Australian alcohol or other drug treatment services in response to VSU, although there is little research as to the efficacy of this form of intervention [1, 157]. Since 2008 the Australian Department of Health (DoH) has spent an estimated \$4 million on treatment

services for petrol sniffing, primarily in the NT [10]. Despite this commitment, there is a shortage of services to treat chronic volatile substance users, particularly in remote areas. The services that do exist are largely located in the NT, and there are often protracted delays and complications associated with accessing these services for volatile substance users outside the NT [10]. To complicate matters, there is a lack of consensus among stakeholders about:

- the definition of 'treatment'
- relative merits of residential services
- intensive case management
- the role of pharmaceutical management
- treatment for experimental users
- providing culturally appropriate and safe treatment [10].

BushMob house

BushMob is a small treatment centre located in Alice Springs, which has the capacity to care for up to 20 people in-house at a time [158]. Funded by the NT Government, BushMob takes clients with a range of issues including those mandated under the NTVSAPA [10]. BushMob provides treatment and stabilisation for young people, aged primarily between 12 and 18 years, who are experiencing problems with sniffing or other drugs. They also have the capacity to provide accommodation for carers in addition to young people [106]. Their approach is stabilisation and treatment, and they provide client services such as food, medical attention and living conditions [106]. Rather than providing thrill seeking and action packed activities that may compete with VSU [14], BushMob run outreach programs that are designed to give substance users 'time out' from whatever problems are faced in their daily lives [106]. These include regular bush trips, which are client-driven.

The BushMob approach places a high value on individual commitment to recovery and empowerment of those in treatment [106]. As such, while BushMob accepts people mandated under the NTVSAPA, they do not force people to stay in treatment. Being a centrally-located town-based treatment facility, this means that if people do not wish to stay in treatment, they have the means and opportunity to leave, even if mandated.

Homelands programs

Homelands, or Outstation programs, have been seen as a beneficial response to VSU in Indigenous communities in two primary ways: (1) for prevention since families who move to outstations are less likely to face substance use problems; and (2) for remediation giving users a break from misusing and having the opportunity to become involved in other activities [14].

Mt Theo, Yuendumu

The *Warlpiri Youth Development Aboriginal Corporation* (WYDAC), colloquially known as the *Mt Theo program*, is widely regarded as a success story in preventing petrol sniffing and VSU in Yuendumu. The program is the result of collaboration between a group of Yuendumu Elders, primarily Johnny Hooker Creek, Peggy Brown, and a white Australian youth-worker, Andrew Stojanovski, which began in 1994. The program took a dual approach to addressing the problem of substance use and petrol sniffing in the community by:

- providing proactive diversionary activities in the Yuendumu community during 'prime sniffing time' [159 p.292], such as weekends, after school, nights and school holidays, sometimes until after midnight
- removing young people who were at risk of using substances or offending to the Mt Theo outstation for periods of up to six months. This time period was determined on community Elder's assessment of whether that individual was able to return to the community [159, 160]. These efforts had the effect of stopping individuals from being able to use substances, due to a total lack of supply, as well keeping them from participating in the recruitment of other young people to engage in similar behaviours.

The combination of these two approaches had the effect of disrupting the petrol sniffing cycle that existed within Yuendumu, and prevented the next generation of young people from continuing entrenched petrol sniffing culture [159]. Whereas sniffing petrol was once the cool thing to do for teenagers in Yuendumu, and sniffing houses were the places for boys to go to chat up girls, the *Mt Theo program* changed the ingrained culture so sniffing in Yuendumu became a marginalized activity that young people wanted no part of [106, 159].

In the last decade, the program has expanded to include new components, including diversion, treatment, aftercare, mentoring and youth development with some of these services now extending to other Warlpiri communities [160, 161]. Further, under the NTVSAPA, the program accepts court-ordered clients from other communities if they are of Warlpiri descent. The *Mt Theo program* is a way in which people in Yuendumu have been able to exercise collective community action to improve the community's welfare and wellbeing.

Yuendumu is located approximately 350 kilometres from Alice Springs, and the Mt Theo outstation lies another 140 kilometres north-west from Yuendumu. It is very isolated, making it almost impossible for young people to leave without assistance, and operates with strong cross-cultural partnerships between Indigenous and non-Indigenous program staff, allowing the program flexibility in terms of cultural authority and kinship obligations [106].

Development of volatile substance use clinical practice guidelines

The lack of systematic guidelines for health staff to assist with the identification and management of VSU was identified as a part of the PSS. In recognition that treatment options for other substances may not be generalisable to VSU, DoH funded the Australian National Health and Medical Research Council (NH&MRC) to develop clinical practice guidelines specifically for VSU. Released in late 2011, the guidelines provide health workers with information to assist with the identification, assessment and management of people who use volatile substances in urban and remote areas [10, 128]. They have been designed to be used by health professionals including: medical practitioners; nurses; Aboriginal and Torres Strait Islander Health Workers; alcohol and other drug workers; and allied mental health workers. They are evidence-based and applicable in primary health, emergency, mental health, and alcohol and other drug service settings.

Chelation therapy

Chelation therapy is the most commonly used treatment for lead poisoning, and reduces symptom severity and lead levels by mobilising inorganic lead in the blood [2]. Tetraethyl lead is thought to be the predominant cause of long-term neurotoxicity, and the complex metabolism and long half-life means it can be preserved in the body for more than 10 years [29, 43]. Although leaded petrol was phased out in Australia beginning in January 2002, chronic petrol sniffers have likely inhaled a combination of leaded and unleaded petrol. There have, however, been no reported admissions for lead encephalopathy to regional hospitals following the phase out of leaded petrol in January 2002, despite the ongoing use of unleaded petrol [29, 32, 35].

Although chelation therapy has been associated with improvements in lead encephalopathy arising from chronic petrol sniffing, long-term neurological impairments are often permanent due to the fact that chelating agents are not able to bind with all compounds contained in leaded products [162-164]. Increasing exposure to leaded petrol has been associated with significant neurological dysfunction that is still evident years after hospitalisation. Lead encephalopathy is characterised by decreased consciousness, tremors, severe motor impairment and convulsive seizures. Emergency hospitalisation is often required, followed by long-term in-patient intensive care treatment [35]. With the phase out of leaded petrol, chelation therapy is now used considerably less as a frontline treatment for VSU, however, it remains one response for users of leaded products.

Harm minimisation

Although the broad objective of many approaches is to control, prohibit or prevent behaviours from occurring, harm minimisation aims to reduce the associated harms. Harm minimisation is based on the premise that dangerous behaviours will occur. When preventative, prohibitive and compliance approaches are unsuccessful or inappropriate, the harms involved can be minimised. Harm minimisation is especially important when dealing with drug and alcohol issues, as these can be viewed as health concerns and cannot be appropriately or effectively addressed through criminal justice sanctions, interventions or penalties. Often, policies related to health issues are dependent on what is politically achievable, rather than what is politically optimal. This is apparent through the public demand for criminal sanctions for drug users and sellers when, from a criminological standpoint, adversarial approaches are ineffective [165].

On the whole, Australia has demonstrated a commitment to approaching substance use from a harm minimisation perspective, and formulating harm reduction strategies into drug policy [174]. A harm minimisation approach to VSU may depend on the substance and the setting. Petrol sniffing in Indigenous communities is primarily perceived as a health issue, whereas chroming in urban settings is largely seen as a threat to the morality and functioning of a community and is more likely to be characterized as a crime prevention issue [167].

In regards to VSU, the risk of serious consequences, including death, highlights the need for making users aware of harm reduction options. Such options have rarely been featured in previous responses to VSU, due to the 'moral panic' such strategies, particularly supervised use, would have previously elicited [168]. Perhaps less controversial than facilitating supervised use, is educating users about strategies they can use to reduce the likelihood of death. Several harm reduction practices for users are described in the literature [130, 169]. These include:

- reducing the risk of burns by using volatile substances away from fires and cigarettes
- reducing the risk of injuries by using volatile substances away from roads or rivers
- reducing the risk of suffocation by not sniffing in cupboards or using blankets or coverings to concentrate fumes
- using substances in outside areas where there is more air that can be inhaled with the volatile substance, and where communities members can see if help is needed
- not startling or chasing anyone affected by volatile substances, as sudden death appears more likely when a user's heart rate is elevated

- avoiding the use of other drugs at the same time as volatile substances (particularly drugs such as alcohol and heroin which are also central nervous system depressants) so as to reduce the risk of overdose
- knowing that choking on vomit is a significant cause of VSU associated death and ensuring that a person who passes out as a result of VSU can breathe before calling an ambulance.

Strategies that are commonly used under a harm minimisation approach focus on minimising harm by prioritising the health of the public and broader community. For volatile substance users, these include outstation programs, where the user is removed to a place of safety, and is provided with physical and emotional care by family and community members [66, 120]. Treatment and education focusing on health risks and values, in combination with long-term social reforms rather than scare tactics, are more effective in minimising the harm associated with substance use than criminal punishments through crime policy [165].

Law enforcement

Although in Australia it is generally accepted that VSU is a health and welfare rather than criminal justice issue, there has been contention by some police officers, policy and community agencies about whether VSU is or should be a police matter or public health issue [17, 71]. VSU is not a criminal offence anywhere in Australia, but poses a significant challenge for law enforcement agencies, particularly as users are at risk of harming themselves or others, damaging property and threatening family and community wellbeing. Further, while intoxicated, volatile substance users are at high risk of suffering cardiac arrhythmias or sudden sniffing death, which has been associated with the user being startled or agitated. Such a response may be triggered by pursuit or intervention by police [15]. Without police support, however, the burden for responding to VSU is placed on health and welfare agencies, which can find it difficult to intervene [106].

Although VSU is not a crime, some Australian jurisdictions have increased police powers to intervene in cases involving VSU, and others have legislated for police to be actively involved in the regulatory response. A Qld evaluation of police powers found that amended police powers had served a useful role, but there was a perception that police had been given the primary responsibility for responding to VSU. As such, health and welfare agencies did not often follow-up with cases of VSU [170].

Another study conducted in 2006 examining police attitudes towards VSU, found a significant proportion of police did not think that addressing VSU should be a police responsibility. They gave various reasons, including that:

- the primary role of police is to focus on criminals
- VSU is a health concern, rather than a police one
- volatile substances are best addressed by the community or family of the user [17].

In contrast, however, in the NT VSU was considered by community agencies to be a police issue, with a need for police to have a role in searching and seizing substances, apprehending people, and recommending assessments for mandatory treatment orders under the NTVSAPA [17].

Four main responsibilities for police in responding to VSU have been identified under a harm minimisation approach:

1. protect the community
2. investigate crimes that occur whilst substance users are intoxicated
3. disrupt the supply of substances
4. liaise with health and other community workers [17].

A recent evaluation of the PSS recommended that future efforts be directed towards achieving best-practice policing in remote areas, ensuring that individual police:

- understand the context of sniffing or VSU
- understand their powers to intervene under appropriate legislation
- are proactive in engaging with other services
- are willing to go beyond just responding to breaches of the peace or law and help identify and engage with youth at risk
- work within a broader community approach to tackle sniffing by visiting retailers and encouraging them to secure volatile substances
- are skilled in working with Aboriginal communities [10].

Police involvement in a consultative capacity, creating links with health and welfare agencies, is critical for an effective response to VSU.

Concluding comments

The past decade has seen an increased response to VSU in terms of: coordinated government approaches; preventative, strategic and well evaluated programs; and strategies that involve manufacturers modifying products to prevent their misuse. Government resources have been invested into longer-term VSU resources, and an increased focus on integrated policy frameworks.

The roles of BP and Shell in manufacturing LAF, in addition to White Knight, Dulux, Plasti-kote, Motor Tech and Export in manufacturing low-toxicity spray paints, have demonstrated the critical role that industry can play in combating VSU through the provision of safer products. Affected communities also continue to play an active role through measures such as community programs and patrols and outstation programs. The implementation of concurrent strategies addressing the supply, demand and some harms of VSU, has led to a substantial decline of petrol sniffing especially in remote Aboriginal communities. Other forms of VSU in the general population, however, continue at similar rates. Data from the 2013 NDSHS illustrated a slight overall increase in use since 2010 [81].

There are further opportunities for improvement as the focus of treatment programs has been on the proximal factors of use, rather than the underlying causes of VSU and other destructive health behaviours. The most effective strategies for combating VSU are those that are able to address and improve young peoples' lives and the health and wellbeing of families and communities over the long term. This involves taking measures to redress socio-economic disadvantage experienced by Indigenous communities.

Strategies that are consultative, empowering, public-spirited and community-based are more likely to be effective because they are tailored to the community and are community driven and owned. Further, the sense of ownership and empowerment ensures that community members are actively engaged and involved in the response process, rather than passively on the receiving end of directive policy.

References

1. National Inhalant Abuse Taskforce (2006) *National directions on inhalant use: final report*. Melbourne: Victorian Department of Human Services
2. Burns C, d'Abbs P, Currie B (1995) Patterns of petrol sniffing and other drug use in young men from an Australian Aboriginal community in Arnhem Land, Northern Territory. *Drug and Alcohol Review*; 14(2):159-169
3. Senate Community Affairs References Committee (2010) *Combined Australian Government response to two Senate Community Affairs References Committee reports on petrol sniffing in Indigenous communities*. 2009. Canberra: Department of Families, Housing, Community Services and Indigenous Affairs
4. Senate Standing Committee on Community Affairs (2009) *Inquiry into Petrol Sniffing and Substance Abuse in Central Australia*. Retrieved 2009 from http://www.aph.gov.au/Parliamentary_Business/Committees/Senate/Community_Affairs/Completed_inquiries/2008-10/petrol_sniffing_substance_abuse08/index
5. Standing Committee on Community Affairs (2009) *Grasping the opportunity of Opal: assessing the impact of the Petrol Sniffing Strategy*. Canberra: Senate Community Affairs Committee, Parliament of Australia
6. Senate Select Committee on Regional and Remote Indigenous Communities (2010) *Select Committee on Regional and Remote Indigenous Communities: final report 2010*. Canberra: Parliament of Australia
7. Robertson EA, Senate Select Committee on *Volatile Substance Fumes (1985) Volatile substance abuse in Australia*. Canberra: The Parliament of the Commonwealth of Australia
8. Select Committee on Substance Abuse in the Community (2004) *Petrol sniffing in remote Northern Territory communities*. Darwin: Select Committee on Substance Abuse in the Community, Legislative Assembly of the Northern Territory
9. Community Affairs References Committee (2006) *Beyond petrol sniffing: renewing hope for Indigenous communities*. Canberra: Commonwealth of Australia
10. Marcus D, Shaw D (2013) *Whole of strategy evaluation of the petrol sniffing strategy: future directions for the PSS: final report*. Canberra: Department of Families, Housing, Community Services and Indigenous Affairs
11. d'Abbs P, Shaw G (2013) *Monitoring trends in prevalence of petrol sniffing in selected Aboriginal communities: an interim report*. Darwin: Menzies School of Health Research
12. Australian National Audit Office (2015) *Delivery of the Petrol Sniffing Strategy in remote Indigenous communities*. (ANAO Report No.35 2014–15) Canberra: Department of the Prime Minister and Cabinet
13. Midford R, MacLean S, Catto M, Thomson N, Debuyst O (2011) *Review of volatile substance use among Indigenous people*. (Australian Indigenous HealthReviews no. 6) Perth, WA: Australian Indigenous HealthInfoNet
14. d'Abbs P, Maclean S (2008) *Volatile substance misuse: a review of interventions*. (Monograph Series No. 65) Barton, ACT: Australian Government Department of Health and Ageing
15. Lubman DI, Hides L, Yucel M (2006) Inhalant misuse in youth: time for a coordinated response. *Medical Journal of Australia*;185(6):327-330
16. American Psychiatric Association (2014) *Diagnostic and statistical manual of mental disorders*. Retrieved 2014 from <http://www.dsm5.org/Pages/Default.aspx>
17. Gray D, Shaw G, d'Abbs P, Brooks D, Stearne A, Mosey A, Spooner C (2006) *Policing, volatile substance misuse, and Indigenous Australians*. (Monograph series no. 16) Canberra: Australian Institute of Aboriginal and Torres Strait Islander Studies and Australian Government Department of Health and Ageing
18. National Institute on Drug Abuse (2012) *NIDA InfoFacts: inhalants*. Retrieved 2010 from <http://drugabuse.gov/infofacts/inhalants.html>
19. Marc Galanter M, Kleber HD, Brady KT, eds. (2008) *The American Psychiatric publishing textbook of substance abuse treatment*. 5th ed. USA: American Psychiatric Association
20. Lowinson JH, Ruiz P, Millman RB, Langrod JG, eds. (2005) *Substance abuse: a comprehensive textbook*. Philadelphia: Lippincott Williams & Wilkins
21. Victorian Department of Human Services (2011) *About inhalant abuse for health and community workers*. Melbourne: Victorian Department of Human Services
22. Garland EL, Howard MO (2012) *Volatile substance misuse*. *CNS Drugs*;26(11):927-935
23. MacLean S (2005) "It might be a scummy-arsed drug but it's a sick buzz": chroming and pleasure. *Contemporary Drug Problems*; 32(2):295-318
24. Cruz SL (2011) The latest evidence in neuroscience of solvent misuse: an article written for service providers. *Substance Use & Misuse*; 46(Supp.1):62-67
25. Brouette T, Anton R (2001) Clinical review of inhalants. *The American Journal on Addictions*;10(1):79-94

26. Dinwiddie SH (1994) Abuse of inhalants: a review. *Addiction*;89(8):925-939
27. Goodheart R, Dunne J (1994) Petrol sniffer's encephalopathy: a study of 25 patients. *Medical Journal of Australia*;160:178-181
28. National Institute on Drug Abuse (2005) *Research report series – inhalant abuse*. Maryland: National Institute on Drug Abuse
29. Cairney S, Maruff P, Burns CB, Currie J, Currie BJ (2005) Neurological and cognitive recovery following abstinence from petrol sniffing. *Neuropsychopharmacology*;30(5):1019-1027
30. Jensen AA (1984) Metabolism and toxicokinetics (pg 97-115). In: Grandjean P, ed. *Biological effects of organolead compounds*. Boca Raton, Fla: CRC Press
31. Grandjean P, Landsdown R (1986) The measurement of lead (pg 41-53). In: Landsdown R, Yule W, eds. *The lead debate: the environment, toxicology and child health*. London, UK: Croom Helm
32. Cairney S, Maruff P, Burns CB, Currie J, Currie BJ (2004) Saccade dysfunction associated with chronic petrol sniffing and lead encephalopathy. *Journal of Neurology, Neurosurgery and Psychiatry*;75(3):472-476
33. Bass M (1970) Sudden sniffing death. *Journal of the American Medical Association*;212(12):2075-2079
34. Chivell WC (2002) *Finding of inquest: inquest into the death of Kunmanara Thompson*. Adelaide: South Australian Coroner's Court
35. Cairney S, Maruff P, Burns CB, Currie J, Currie B (2004) Neurological and cognitive impairment associated with leaded gasoline encephalopathy. *Drug and Alcohol Dependence*;73(2):183-188
36. Dingwall KM, Cairney S (2010) Psychological and cognitive assessment of Indigenous Australians. *Australian and New Zealand Journal of Psychiatry*;44(1):20-30
37. Cairney S, Maruff P (2007) Petrol sniffing, the brain, and Aboriginal culture: between sorcery and neuroscience. In: Cohen H, Stemmer B, eds. *Consciousness and cognition: fragments of mind and brain*. London: Academic Press:225-243
38. Cairney S, Dingwall K (2010) The mysterious practice of petrol sniffing in isolated Indigenous groups. *Journal of Paediatrics and Child Health*;46(9):510-515
39. Cairney S, Clough AR, Maruff P, Collie A, Currie BJ, Currie J (2003) Saccade and cognitive function in chronic kava users. *Neuropsychopharmacology*;28:389-396
40. Boeckx RL, Postl B, Coodin FJ (1977) Gasoline sniffing and tetraethyl lead poisoning in children. *Pediatrics*;60(2):140-145
41. Coulehan JL, Hirsch W, Brillman J, Sanandria J, Welty TK, Colaiaco P, Koros A, Lober A (1983) Gasoline sniffing and lead toxicity in Navajo adolescents. *Pediatrics*;71(1):113-117
42. Dingwall KM, Cairney S (2011) Recovery from central nervous system changes following volatile substance misuse. *Substance Use & Misuse*;46(S1):73-83
43. Dingwall KM, Maruff P, Fredrickson A, Cairney S (2011) Cognitive recovery during and after treatment for volatile solvent abuse. *Drug and Alcohol Dependence*;118(2-3):180-185
44. Rosenberg NL, Sharp CW (1997) Solvent toxicity: a neurological focus. *Substance Use & Misuse*;32(12-13):1859-1864
45. Dingwall K, Cairney S (2009) The importance and challenges of assessing cognition in Indigenous Australians. *Australasian Psychiatry*;17(S1):S47 - S50
46. Jones H, Balster R (1998) Inhalant abuse in pregnancy. *Obstetrics & Gynecology Clinics of North America*;25:153-167
47. Ives R (2006) Volatile substance abuse: a review of findings in ESPAD 2003. *Drugs: Education, Prevention, and Policy*;13(5):441-449
48. Commission on Narcotic Drugs (1999) *Youth and drugs: a global overview*. Vienna: United Nations Economic and Social Council
49. World Health Organization (1999) *Volatile solvents abuse: a global overview*. Geneva: World Health Organization
50. Substance Abuse and Mental Health Services Administration (2011) *Results from the 2010 National Survey on Drug Use and Health: summary of national findings*. (NSDUH Series H-41, HHS Publication No. (SMA) 11-4658) Rockville, Maryland: Substance Abuse and Mental Health Services Administration
51. Parliament of Victoria Drugs and Crime Prevention Committee (2002) *Inquiry into the inhalation of volatile substances: final report*. Melbourne: Parliament of Victoria
52. Australasian Centre for Policing Research (2004) *The policing implications of volatile substance misuse*. Marden, SA: Australasian Centre for Policing Research
53. Ogwang T, Cox L, Saldanha J (2006) Paint on their lips: paint-sniffers, good citizens and public space in Brisbane. *Journal of Sociology*;42(4):412-428

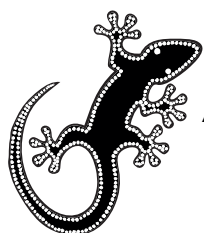
54. Mosey A (1994) *Remote area night patrols*. Alice Springs: Drug and Alcohol Services Association
55. Rose J, Daly A, Midford R (1992) *Volatile substance use in Perth: patterns of use, regulation of use, constituents of glue, recommendations for management*. Perth: W.A. Alcohol and Drug Authority
56. Youth Affairs Network of Queensland (2004) *Chroming and young people in Queensland*. Brisbane: Youth Affairs Network of Queensland
57. Karam J, Sinclair G, Rackstraw L (2014) *Dignity, diversion, home and hope: a review of interventions for volatile substance misuse in regional North Queensland*. Canberra: Australian Department of the Prime Minister and Cabinet
58. Carroll A, Houghton S, Odgers P (1998) Volatile solvent use among Western Australian adolescents. *Adolescence*;33(132):877–889
59. Cheverton J, Schrader T, Scrogings Z (2003) *Sniffing around the valley: chroming in Brisbane's inner-city*. Brisbane: Brisbane Youth Service
60. Northern Territory Coroner's Office (2005) *Inquest into the deaths of Kumanjay Presley, Kunmanara Coulthard and Kunmanara Brumby*. Darwin: Northern Territory Coroner's Office
61. d'Abbs P, MacLean S (2000) *Petrol sniffing in Aboriginal communities: a review of interventions*. Darwin: Cooperative Research Centre for Aboriginal and Tropical Health
62. Brady M (1992) *Heavy metal: the social meaning of petrol sniffing in Australia*. Canberra: Aboriginal Studies Press
63. Brady M (1995) Culture in treatment, culture as treatment: a critical appraisal of developments in addictions programs for Indigenous North Americans and Australians. *Social Science & Medicine*;41(11):1487-1498
64. Phillips G (2003) *Addictions and healing in Aboriginal country*. Canberra: Aboriginal Studies Press
65. Rose J, Western Australian Solvents Abuse Working Party (2001) *Volatile substance abuse: background paper*. Perth, WA: Department of Health & Drug Alcohol Office
66. Shaw G, Biven A, Gray D, Mosey A, Stearne A, Perry J (2004) *An evaluation of the Comgas scheme: they sniffed it and they sniffed it but it just wasn't there*. Canberra: Department of Health and Ageing
67. Cunneen C (2001) *The impact of crime prevention on Aboriginal communities*. Sydney: Institute of Criminology, University of Sydney
68. Brady M (2011) Fuel, cars and the geography of petrol sniffing. *Humanities Research*;17(2):121-134
69. South Australian Centre for Economic Studies (2010) *Cost benefit analysis of legislation to mandate the supply of opal fuel in regions of Australia: final report*. Adelaide: Australian Government Department of Health and Ageing
70. Dingwall KM, Maruff P, Clough AR, Cairney S (2012) Factors associated with continued solvent use in Indigenous petrol sniffers following treatment. *Drug and Alcohol Review*;31(1):40–46
71. Gray D, Pulver LJ, Saggars S, Waldon J (2006) Addressing Indigenous substance misuse and related harms [editorial]. *Drug and Alcohol Review*;25(3):183-188
72. Freedenthal S, Vaughn MG, Jenson JM, Howard MO (2007) Inhalant use and suicidality among incarcerated youth. *Drug and Alcohol Dependence*;90(1):81-88
73. Kirmayer LJ, Boothroyd LJ, Hodgins S (1998) Attempted suicide among Inuit youth: psychosocial correlates and implications for prevention. *Canadian Journal of Psychiatry*;43(8):816-822
74. Jacobs AM, Ghodse AH (1987) Depression in solvent abusers. *Social Science & Medicine*;24(10):863-866
75. Daniels AM, Latcham RW (1984) Petrol sniffing and schizophrenia in a pacific island paradise. *The Lancet*;23(8373):389
76. Howard MO, Perron BE, Vaughn MG, Bender KA, Garland E (2010) Inhalant use, inhalant-use disorders, and antisocial behavior: findings from the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC). *Journal of studies on alcohol and drugs*;71(2):201-209
77. Howard MO, Perron BE, Sacco P, Ilgen M, Vaughn MG, Garland E, Freedenthal S (2010) Suicide ideation and attempts among inhalant users: results from the National Epidemiologic Survey on Alcohol and Related Conditions. *Suicide and Life-Threatening Behavior*;40(3):276-286
78. Wu LT, Howard MO (2007) Psychiatric disorders in inhalant users: results from the National Epidemiologic Survey on Alcohol and Related Conditions. *Drug and Alcohol Dependence*;88(2-3):146–155
79. Wu LT, Howard MO, Pilowsky DJ (2008) Substance use disorders among inhalant users: results from the National Epidemiologic Survey on Alcohol and Related Conditions. *Addictive Behaviors*;33(7):968–973
80. Central Australian Youth Link Up Service (2008) *Central Australian Youth Link Up Service submission to the Senate Select Committee on Regional and Remote Communities*. Canberra: Parliament of Australia
81. Australian Institute of Health and Welfare (2014) *National Drug Strategy Household Survey (NDSHS) 2013 data and references*. Retrieved 2013 from <http://www.aihw.gov.au/alcohol-and-other-drugs/ndshs/2013/data-and-references/>

82. White V, Bariola E (2012) *Australian secondary school students' use of tobacco, alcohol, and over-the-counter and illicit substances in 2011*. Canberra: Drug Strategy Branch, Australian Government Department of Health and Ageing
83. Australian Institute of Health and Welfare (2011) *2010 National Drug Strategy Household Survey report*. (Drug statistics series no. 25. Cat. no. PHE 145) Canberra: Australian Institute of Health and Welfare
84. Mosey A (1997) *Report on petrol sniffing in Central Australia*. Darwin: Territory Health Services
85. Department of Families Housing Community Services and Indigenous Affairs, Department of Health and Ageing, Department of Education Employment and Workplace Relations, Attorney-General's Department (2008) *Submission to the Senate inquiry into petrol sniffing and substance abuse in Central Australia*. Canberra: Government of Australia
86. d'Abbs P, Shaw G (2007) *Data collection for the Petrol Sniffing Prevention Program*. Canberra: Department of Health and Ageing, Australia
87. Freeman P (1985) *Petrol sniffing in Amata South Australia*. Alice Springs: Nganampa Health Council,
88. Access Economics (2006) *Opal cost benefit analysis*. Canberra: The Opal Alliance
89. Stoové M, Jenkinson R, Matthews S, Dietze P, Laslett AM, Clemens S, Cvetkovski S, Barratt M, McElwee P (2005) *Victorian drug statistics handbook 2005: patterns of drug use and related harm in Victoria*. Melbourne: Victorian Government Publishing Service
90. National Drug Abuse Information Centre (1988) *Deaths due to volatile substance abuse*. (Statistical Update No. 8) Canberra: Australian Government Publishing Service
91. MacLean S, D'abbs PH (2006) Will modifying inhalants reduce volatile substance misuse? A review. *Drugs: Education, Prevention, and Policy*;13(5):423-439
92. Field-Smith ME, Butland BK, Ramsey JD, Anderson HR (2006) *Trends in death associated with abuse of volatile substances 1971-2004*. London: Division of Community Health Sciences, St George's University of London
93. Department of the Environment and Heritage (2006) *Stockholm convention on persistent organic pollutants: Australia's national implementation plan*. Canberra: Department of the Environment and Heritage, Australia
94. Australian Drug Foundation (2015) *Inhalants*. Retrieved 2015
95. White Knight (2015) *Low tox aerosol: safe to spray*. Retrieved 2015
96. Marel C (2008) *Substituting reduced-toxicity spray paints for aromatic spray paints and the effect on suspicious sales*. Alice Springs: Central Australian Youth Link Up Service
97. Alcohol and Other Drugs Council of Australia (2005) *Submission to the Inquiry into petrol sniffing in remote Aboriginal communities*. Woden, ACT: ADCA
98. MacKenzie M, Johnson PD (2004) *A broad evaluation of the Petrol Sniffing and Other Solvents kit*. Adelaide: Aboriginal Drug and Alcohol Council of South Australia
99. d'Abbs P, Shaw G (2008) *Executive summary of the "Evaluation of the impact of Opal fuel"*. Canberra: Department of Health and Ageing, Australia
100. Australian Government (2015) *Building and expanding the low aromatic unleaded fuel rollout*. Retrieved 2015 from <https://www.lowaromaticunleaded.gov.au/building-and-expanding-low-aromatic-unleaded-fuel-rollout>
101. Australian Government (2014) *Minister Scullion: Low aromatic fuel storage tank for the Top End*. Retrieved 14 January 2014 from <http://www.indigenous.gov.au/minister-scullyion-low-aromatic-fuel-storage-tank-for-the-top-end>
102. Australian Government (2015) *Roll-out of LAF continues in 2015*. Retrieved 9 February 2015 from <https://www.lowaromaticunleaded.gov.au/news-and-events/roll-out-laf-continues-2015>
103. Taylor JC, Field-Smith ME, Norman CL, Ramsey JD, Anderson HR (2000) *Trends in deaths associated with abuse of volatile substances 1971-1998*. London: Department of Public Health Sciences and the Toxicology Unit, Department of Cardiological Services, St George's Hospital Medical School
104. Helfgot S, Rose J (1994) Maximum prevention with minimal intervention: intervention with a retail hardware store. *Pro-Ed*;10(1):19-20
105. Mosey A (2004) *Retailers responsible sale of solvents resource and voluntary code of conduct for sale of solvents in the Northern Territory*. Alice Springs: Central Australian Youth Link Up Service, Tangentyere Council
106. Marel A (2011) *Contested domains: regulating responses to volatile substance misuse in the Alice Springs town camps*. University of New South Wales, Sydney
107. Shaw G (2010) *Research into legislation relating to petrol sniffing - executive summary*. Canberra: Department of Families, Housing, Community Services and Indigenous Affairs
108. Divakaran-Brown C, Minutjukur A (1993) *Children of dispossession: an evaluation of petrol sniffing on Anangu Pitjantjatjara lands*.

109. Franks C (1989) *Preventing petrol sniffing in Aboriginal communities. Community Health Studies*;13(1):4-12
110. Scrimgeour D, Rowse T, Bryce S (1991) *HALT: an evaluation [Healthy Aboriginal Lifestyle Team]*. Alice Springs: Menzies School of Health Research
111. Rowse T (1996) *Traditions for health: studies in Aboriginal reconstruction*. Canberra: North Australia Research Unit [NARU]
112. Central Australian Youth Link Up Service (2015) *About CAYLUS*. Retrieved 2015 from <http://caylus.org.au/new-folder/#about>
113. Shaw G (2013) *Feedback from stakeholders on support provided by CAYLUS to youth programs in Central Australia*. Alice Springs: Central Australian Youth Link Up Service
114. Gray D, Stearne A (2004) *Makin tracks: final evaluation report*. Perth, WA: National Drug Research Institute
115. Gray D (2002) *Makin tracks: annual evaluation report: 2001-2002*. Perth, WA: National Drug Research Institute
116. Stearne A (2007) *Makin' tracks (2004 – 2007) summary evaluation*. Perth, WA: National Drug Research Institute
117. Warhaft G (2014) A travellin' man. *Of Substance*;12(1):22-23
118. MacLean S (2012) *Developing an inhalant misuse community strategy: second edition*. 2nd ed. Canberra: National Inhalants Information Service
119. Robertson J (2007) *Cairns inhalant action group: strategy plan*. Cairns: Wuchopperen Health Service
120. MacLean SJ, d'Abbs PHN (2002) Petrol sniffing in Aboriginal communities: a review of interventions. *Drug and Alcohol Review*;21(1):65-72
121. Delahunty B, Putt J (2006) *The policing implications of cannabis, amphetamine and other illicit drug use in Aboriginal and Torres Strait Islander communities*. (Monograph series no.15) Canberra: Australian Institute of Aboriginal and Torres Strait Islander Studies and Australian Government Department of Health and Ageing
122. Blagg H (2008) *Crime, Aboriginality and the decolonisation of justice*. Annandale, NSW: Hawkins Press
123. Blagg H (2003) *An overview of night patrol services in Australia*. Barton, ACT: Crime Prevention Branch, Attorney General's Department
124. Badger B (2005) *Can new non-toxic products eliminate petrol sniffing behaviours in remote Indigenous communities?* RMIT University, Melbourne, Victoria
125. Mosey A (2000) *Dry spirit: petrol sniffing interventions in the Kutjungka region, WA*. Perth, WA: Mercy Community Health Service Kutjungka Region, Western Australia
126. Senior K, Chenhall R (2007) 'Stopping sniffing is our responsibility': Community ownership of a petrol-sniffing program in Arnhem Land. *Health Sociology Review*;16(3-4):315-327
127. Ohlin J, Ross S, Wilczynski A, Pigott R, . . , Connell J, Reed-Gilbert K (2010) *Review of certain FaHCSIA funded youth services: final report*. Sydney: Urbis
128. National Health and Medical Research Council (2011) *Consensus-based clinical practice guideline for the management of volatile substance use in Australia*. Canberra: National Health and Medical Research Council
129. Bystrycki A, Coleridge J (2000) Drug-and poison-related deaths in Victoria during 1997. *Emergency Medicine*;12(4):303-309
130. Taskforce on Butane Misuse (2006) *Western Australian Taskforce on Butane Misuse: report and recommendations*. Perth: Western Australia Drug and Alcohol Office
131. Bellhouse R, Johnston G, Fuller A, Guthrie C (2000) *Volatile solvents: a resource for schools*. Melbourne: Victorian Department of Education and Training
132. Roper S, Shaw G (1996) *"Moving on": a report on petrol sniffing and the impact of the introduction of AVG on the Anangu Pitjantjatjara lands*. Canberra: Department of Human Services and Health
133. NSW National School Drug Education Strategy (2002) *Sniffing: the dangers of solvent use by young people*. Sydney: NSW Department of Education and Training
134. NSW Department of Education and Training (2010) *Drugs in schools: procedures for managing drug related incidents*. (Drugs in schools policy PD20020040) Sydney: NSW Department of Education and Training
135. Parliament of Victoria Drugs and Crime Prevention Committee (2002) *Inquiry into the inhalation of volatile substances: discussion paper*. Melbourne: Parliament of Victoria
136. Department of Health & Human Services (2011) *School students and drug use: 1996 survey of alcohol, tobacco and other drug use among Victorian secondary school students*. Melbourne: Department of Health & Human Services
137. MacLean S (2007) Should inhalants be included in Australian school-based drug education? *Youth Studies Australia*;26(1):25-31
138. Flanagan R, Ives R (1994) Volatile substance abuse. *Bulletin on Narcotics*;46(2):49-78

139. Foxcroft DR, Tsertsvadze A (2011) *Universal school-based prevention programs for alcohol misuse in young people*. Cochrane Database of Systematic Reviews 11.
140. Faggiano F, Vigna-Taglianti FD, Versino E, Zambon A, Borraccino A, Lemma P (2005) *School-based prevention for illicit drugs' use*. Cochrane Database of Systematic Reviews 18.
141. Johnson KW, Shamblen SR, Ogilvie KA, Collins D, Saylor B (2009) Preventing youths' use of inhalants and other harmful legal products in frontier Alaskan communities: a randomized trial. *Prevention Science*;10(4):298-312
142. Ringwalt CL, Clark HK, Hanley S, Shamblen SR, Flewelling RL (2009) Project ALERT: a cluster randomized trial. *Archives of Pediatrics & Adolescent Medicine*;163(7):625-632
143. Newton NC, O'Leary-Barrett M, Conrod PJ (2013) Adolescent substance misuse: neurobiology and evidence-based interventions. In: Sommer WH, Spanagel R, eds. *Behavioral Neurobiology of Alcohol Addiction*. New York: Springer:685-708
144. Wu L, Pilowsky DJ, Schlenger WE (2004) Inhalant abuse and dependence among adolescents in the United States. *Journal of the American Academy of Child & Adolescent Psychiatry*;43(10):1206-1214
145. Newton NC, Conrod P, Teesson M, Faggiano F (2012) School-based alcohol and other drug prevention. In: Verster J, Brady K, Galanter M, Conrod P, eds. *Drug abuse and addiction in medical illness*. New York: Springer:545-560
146. Coggans N, Shewan D, Henderson M, Davies JB (1991) The impact of school based drug education. *British Journal of Addiction*;86(9):1099-1109
147. National Cannabis Prevention and Information Centre (2012) *Making the link Indigenous program: promoting help-seeking for drug use and mental health issues among Aboriginal & Torres Strait Islander high school students*. Sydney: National Cannabis Prevention and Information Centre
148. Newton NC, Andrews G, Champion KE, Teesson M (2014) Universal Internet-based prevention for alcohol and cannabis use reduces truancy, psychological distress and moral disengagement: a cluster randomised controlled trial. *Preventive Medicine*;65:109-115
149. Newton NC, Andrews G, Teesson M, Vogl LE (2009) Delivering prevention for alcohol and cannabis using the internet: a cluster randomised controlled trial. *Preventive Medicine*;48(6):579-584
150. Newton NC, Teesson M, Vogl LE, Andrews G (2010) Internet-based prevention for alcohol and cannabis use: final results of the Climate Schools course. *Addiction*;105(4):749-759
151. Cairney S, Fitz J (2008) *Sniffing and the brain: when girls and women sniff, when boys and men sniff*. Darwin: Menzies School of Health Research and Niblock Publishing
152. Cultural and Indigenous Research Centre Australia (2006) *Evaluation of the 'Sniffing and the Brain' flipchart resource*. Sydney: Cultural and Indigenous Research Centre Australia
153. Midford R (2006) Looking to the future: providing a basis for effective school drug education. In: Midford R, Munro G, eds. *Drug education in schools: searching for the silver bullet*. Hawthorne, Vic: IP Communications
154. Beauvais F, Wayman JC, Jumper-Thurman P, Plested B, Helm H (2002) Inhalant abuse among American Indian, Mexican American, and non-Latino white adolescents. *The American Journal of Drug and Alcohol Abuse*;28(1):171-187
155. Beauvais F, Jumper-Thurman P, Plested B, Helm H (2002) A survey of attitudes among drug user treatment providers towards the treatment of inhalant users. *Substance Use & Misuse*;37(11):1391-1410
156. MacLean S, Cameron J, Harney A, Lee NK (2012) Psychosocial therapeutic interventions for volatile substance use: a systematic review. *Addiction*;107(2):278-288
157. Ögel K, Coskun S (2011) Cognitive behavioral therapy-based brief intervention for volatile substance misusers during adolescence: a follow-up study. *Substance Use & Misuse*;46(Supp1):128-133
158. BushMob (2015) *BushMob*. Retrieved 2015 from <http://www.bushmob.com.au/>
159. Stojanovski A (2010) *Dog ear cafe: how the Mt Theo Program beat the curse of petrol sniffing*. Melbourne: Hybrid Publishers
160. Mt Theo - Yuendumu Aboriginal Corporation (2007) *Substance misuse annual report 2006/2007*. Mt Theo (NT): Mt Theo - Yuendumu Aboriginal Corporation
161. Warlpiri Youth Development Aboriginal Corporation (2012) *WYDAC Mt Theo Program annual report 2011/2012*. Yuendumu, NT: Warlpiri Youth Development Aboriginal Corporation
162. Gordon JN, Taylor A, Bennett PN (2002) Lead poisoning: case studies. *British Journal of Clinical Pharmacology*;53(5):451-458
163. Cairney S, O'Connor N, Dingwall KM, Maruff P, Shafiq-Antonacci R, Currie J, Currie BJ (2013) A prospective study of neurocognitive changes 15 years after chronic inhalant abuse. *Addiction*;108(6):1107-1114
164. Burns C, Currie B (1995) The efficacy of chelation therapy and factors influencing mortality in lead intoxicated petrol sniffers. *Australian and New Zealand Journal of Medicine*;25:197-203

165. Skolnick J (1999) Drug policy: drug enforcement, violent crime, and the minimalization of harm. In: Rubin EL, ed. *Minimizing harm: a new crime policy for modern America*. Boulder, Colorado: Westview Press
166. Maher L, Dixon D (1999) Policing and public health: law enforcement and harm minimization in a street-level drug market. *British Journal of Criminology*;39(4):488-512
167. d'Abbs PH, Brady M (2004) Other people, other drugs: the policy response to petrol sniffing among Indigenous Australians. *Drug and Alcohol Review*;23(3):253-260
168. Bessant J (2003) Precursors to a media frenzy. *Youth Studies Australia*;22(3):11-17
169. Gobbert S, Keech J, Kelly C, Stubbs E, Trowbridge K (2012) Petrol, paint and other inhalants. In: Lee K, Freeburn B, Ella S, Miller W, Perry J, Conigrave K, eds. *Handbook for Aboriginal alcohol and drug work*. Sydney: University of Sydney:207-216
170. Crime and Misconduct Commission Queensland (2005) *Police powers and VSM: a review*. Brisbane: Crime and Misconduct Commission Queensland



Australian Indigenous HealthInfoNet

The Australian Indigenous HealthInfoNet's mission is to contribute to improvements in Indigenous health by making relevant, high quality knowledge and information easily accessible to policy makers, health service providers, program managers, clinicians, researchers and the general community. We are helping to 'close the gap' by providing the evidence base to inform practice and policy in Aboriginal and Torres Strait Islander health.

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FEATURED ARTWORK

Rain meets creek,
creek meets river, river
meets sea

By William Miller

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ISBN 978-0-7298-0739-8

Core funding
is provided by the
Australian Government
Department of Health

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