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Plain language review of volatile substance use among Aboriginal and Torres Strait Islander people

Trish Amaranti

Australian Indigenous HealthInfoNet

2016

This plain language review of volatile substance use among Aboriginal and Torres Strait Islander people is based on the *Review of volatile substance use among Aboriginal and Torres Strait Islander people* (2015) by Christina Marel, Sarah MacLean and Richard Midford.

Introduction

Volatile substance use (VSU) is the deliberate breathing in of chemical substances by a user to feel drunk, buzzing or excited. Because the user breathes in (or inhales) the chemical substance, these substances are also known as 'inhalants'.

VSU is a problem for both Aboriginal and Torres Strait Islander and non-Indigenous people, and it can have serious effects on families and communities [1, 2]. There have been many reviews, reports and inquiries carried out over the past thirty years which show that VSU is a dangerous problem [3-8]. In recent years progress has been made in preventing VSU, particularly in remote Aboriginal and Torres Strait Islander communities, but there is still work to be done [9-11].

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Why do a review?

This plain language review provides an overview of the key information about VSU, drawing from a number of important reports and key documents. It is valuable for people working in Aboriginal and Torres Strait Islander health in Australia and it expands on the previous version of the *Review of volatile substance use among Indigenous people* [12]. The current review is focused on Australian Aboriginal and Torres Strait Islander people, and does not examine VSU among other Indigenous peoples or other populations around Australia or overseas.

The review begins with a brief explanation of what volatile substances are, the effects of VSU on users, and ways of responding to VSU. The review then looks at ways to reduce the supply of and demand for VSUs, followed by how people respond to treatment in Aboriginal and Torres Strait Islander communities. The review ends with some closing comments.

Although there are many terms to describe inhalant use and misuse, VSU is the name used in this review.

The HealthInfoNet produces a wide range of publications and reviews on specific health topics. In these publications authors sum up and present information from other experts. It is often difficult to decide whether the original works are referring to Aboriginal people only, Torres Strait Islander people only, or to both groups. When this happens, the authors are morally bound to use the terms from the original work, unless they can get more information from the authors or people who hold the copyright to the work. Our readers may see these terms used as well as the term 'Indigenous'. If you have any concerns or questions please to contact the HealthInfoNet for further information.

What are volatile substances?

Volatile substances are chemical mixtures that turn into mist and release fumes at room temperature. They are also called 'inhalants' due to the way users inhale or breathe them into the body [13]. Inhalants slow the body's central nervous system, and when they are inhaled the chemical vapours produce a feeling of intoxication (drunkenness) or altered mind states. When people do this, it is called 'inhalant intoxication' or 'inhalant use disorder' [14].

There are approximately 250 different pharmacological (manmade) drugs and household products available in Australia which can provide an intoxicating effect [15]. These products are generally sorted into four main groups:

- volatile solvents (cleaners)
- aerosols (sprays)
- gases
- nitrates (salts or acids) [15-17].

Table 1. Examples of inhalants

Category	Inhalant
Aerosols	hair sprays deodorants spray paints fabric protector sprays computer cleaners asthma puffers
Solvents	nail polish removers paint remover / thinners correction fluids and thinners permanent marker pens petrol
Gases	fuel gas cigarette lighter fuel refrigerant
Nitrates	poppers, fluids, room odorisers
Anesthetics	gaseous liquid local
Cleaning agents	dry cleaners spot removers degreasers video head cleaners
Food products	whipped cream aerosols (whippets)

Source: Galanter and Kleber, 2008; Lowinson, 2005 [18, 19]

Nitrates are often not classed as volatile substances, as they do not affect the central nervous system [15]. For a list of common inhalants see Table 1.

How are they used?

There are various ways to use volatile substances, the most common ones include:

- inhaling glue that has been squeezed into a plastic bag
- soaking 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 an aerosol directly into the mouth or into a balloon and inhaling the contents
- breathing in chrome paint that has been sprayed into a plastic or paper bag – this is also known as 'chroming' [20].

There are also many different words which are used to describe VSU, including:

- volatile solvent/substance/inhalant abuse
- volatile solvent/substance/inhalant use
- volatile solvent/substance/inhalant misuse
- petrol, paint or glue sniffing/snorting
- chroming
- huffing
- bagging
- popping or dusting [17, 20].

What are the effects of volatile substance use?

The effects that volatile substances have on a user depends on:

- the way they inhale it
- what type of inhalant it is
- how old the user is
- whether they are male or female [20].

Once the chemicals are inhaled they quickly go through the lungs into the bloodstream where they travel to the brain and other organs of the body. The effects on a person are similar to the effects of alcohol and include:

- slurred speech
- poor body control
- extreme happiness
- dizziness
- hallucinations (seeing things that are not there)
- agitation (being extremely unsettled) [15, 21].

Sometimes inhalants may also produce strong feelings of intoxication described as 'buzzing' or 'rushing', with hallucinations and excitement [22 p.301, 23].

Although volatile substances produce very quick results, these feelings only last for a few minutes so users will often continue to inhale for several hours to extend the feelings. Using inhalants for a long time:

- increases the risk of losing consciousness
- increases the risk of suffocation
- causes hangover headaches and drowsiness which can last for hours or days
- causes damage to the kidneys, liver, heart and lungs [17, 24, 25].

Petrol sniffing is extremely dangerous and can have long term health risks. Tetraethyl lead is found in leaded petrol, but is no longer sold in Australia (since January 2002). If it is absorbed into the body it is converted into triethyl lead in the liver and then stored in the bones for up to 10 years after the petrol sniffing has stopped [26-29]. Triethyl lead can cause damage to nerves.

What is sudden sniffing death?

Some inhalants, such as butane, propane and aerosols, have hydrocarbon (organic compounds made up of hydrogen and carbon) gases in them, which can cause sudden death by heart attack. This is known as 'sudden sniffing death'. It happens when a user becomes over-anxious or stressed, perhaps because they have a frightening hallucination or a run-in with the police which can cause the person's heart to start beating too fast and lead to a heart attack. It can happen to healthy young people, even if they have only used once [15-17, 30].

Why does VSU cause asphyxiation or suffocation?

Asphyxiation or suffocation is when the air supply to the body is cut off. Petrol sniffers are at risk of death from asphyxiation or suffocation because they often fall asleep with containers against their faces or blankets over their heads. This results in a lack of oxygen in the lungs because their lungs are full of inhaled petrol fumes [13, 17, 31]. Even though leaded fuel is no longer available in Australia, there is still a risk of asphyxiation with low aromatic Opal¹ fuel, if people use it for sniffing.

If an aerosol or propellant is sprayed directly into a person's mouth this can cause suffocation because of the cooling agents in the substance. This is also known as 'frozen larynx' (where the vocal cord becomes paralysed) [16].

Death and injury can also occur from users:

- having convulsions (fits)
- choking
- receiving fatal injuries (from behaving dangerously while they are intoxicated - this includes getting burns or injuries from the substances exploding) [16].

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 [9], 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.

What are the effects on the body's nervous system and thought processes?

Constant VSU can have a serious effect on users' cognitive abilities (the way a person's thoughts are processed). This can lead to changes in:

- motor skills
- attention span
- memory
- learning ability
- visual and spatial perception [26, 32, 33].

This is described as a decline in cognitive functions, and the severity depends on how long and how much the person uses [16, 26, 32].

Longer-term VSU affects the central nervous system and brain, affecting memory, attention, and motor function, and can lead to dementia, depression and psychosis (mental illness) [34-36]. VSU can also alter the user's behaviour - causing hostility or anger or a general lack of interest. As a result, they may lack judgement and have poor work or social conduct. Other potential long-term effects include dizziness, lethargy, and trance-like states [17].

If VSU involves the use of leaded inhalants like tetraethyl lead, this can result in 'lead encephalopathy' (inflammation of the brain caused by lead) which causes seizures or death [37]. Tetraethyl lead has been linked to users having intense psychotic experiences, and is thought to be the cause of both long-term nerve damage and permanent damage to the part of the brain that controls motor function, attention and language [35, 37-39]. Nervous system damage caused by lead encephalopathy can lead to:

- tremors
- convulsive seizures
- severe movement abnormalities
- loss of vision.

When this occurs the user needs to go to hospital and will require long intensive care and treatment. Even after receiving care there will always be some cognitive damage [26, 32]. There have been differing opinions in previous research about whether cognitive recovery is possible for volatile substance users. Recent research indicates that for some short term users, neurological (body nervous system) recovery may be possible within weeks of stopping use, but will be slower or absent for chronic users [39, 40]. Significant cognitive recovery appears to be possible when the use of substances is stopped prior to development of cerebellar atrophy (neurons in the cerebellum waste away and die) [26, 29, 32, 41]. However, chronic users of lead substances have little chance of reversing the effects of cerebellar degeneration even after they stop using for a long time [26].

It should also be noted that assessing cognitive and neurological damage in Australian Aboriginal and Torres Strait Islander communities can be a problem due to the lack of culturally appropriate assessments. The majority of assessments are based on western systems, and have not been tested for use among Indigenous population groups. They do not account for important cultural and language barriers, which can make things more complicated when examining long-term effects of chronic VSU [33, 42].

How does VSU affect pregnancy and birth?

Volatile substances are easily absorbed into the body and can cross the placental barrier. This can increase the risk of:

- low birth-rate
- pre-term birth (being born before time)
- delays in development of the unborn baby
- neurobehavioural (behaviour relating to nerve and brain use) problems
- physical deformities [43].

Volatile substance use

What is happening with VSU around the world?

Although VSU is reported by many countries as being a problem, the severity of the problem is not acknowledged at the global level [44]. The use of volatile substances is reported in every region in the world, second only to cannabis use in many countries [45]. Information from various sources indicate that large proportions of people have reportedly used a volatile substance at some stage in their life. The countries with the highest number of users are Australia, Romania, Isle of Man, the United Kingdom (UK), the United States of America (USA), Kenya, Cyprus, and Ireland [44, 45].

The people who are most likely to use volatile substances are young people who belong to minority groups (e.g. migrant groups) or those who are not part of 'mainstream' society. This includes young people and Indigenous people in Australia, New Zealand, the USA and Canada. The higher levels of VSU among these groups is likely due to socio-economic factors such as:

- hunger
- poverty
- illness
- low education levels
- high unemployment
- boredom
- feelings of hopelessness.

The drug use is more a result of their situation rather than anything to do with their cultural makeup [13, 31].

Some countries refer to inhalant use as 'illicit drug use' which means comparisons on an international level are difficult. The United States national survey on drug use and health classes inhalants as illicit drugs, along with:

- marijuana
- cocaine (including crack)
- heroin
- hallucinogens
- non-medical use of prescription-type psychotherapeutics (drugs used to help people change their behaviour and overcome problems) [46].

How are volatile substances used in Australia?

In Australia, VSU mainly occurs among young people, both Indigenous and non-Indigenous [47]. There are two general patterns of VSU in Australia:

1. the use of inhalants - most frequently in urban areas - including:
 - glues
 - deodorants
 - spray paints (also known as 'chroming') [15, 48, 49]
2. petrol sniffing - primarily occurs in rural or remote communities [48].

Petrol sniffing does not appear to be common among volatile substance users in urban areas, possibly due to the availability of, and easy access to, other intoxicating substances [15, 48].

VSU in the general population has been recorded in Australia since the 1970s. In a 1974 Queensland survey, 6.5% of school students said they had used an inhalant. By the 1990s, however, VSU had become a wider problem, affecting Indigenous and non-Indigenous people around the country in both large cities and small regional towns. Studies show that young people and older people - both Indigenous and non-Indigenous - can be chronic users, but Indigenous young people are more likely to use volatile substances in greater amounts and for longer periods of time [1, 13, 50].

Like all substance use, VSU cannot be blamed on one cause, but has been linked with a range of risk factors. Young people both Indigenous and non-Indigenous, who feel they are on the outskirts of society, have revealed they use volatile substances to relieve boredom, block hunger pains and cope with emotional stress [51, 52]. VSU is commonly linked to:

- being poor and disadvantaged
- having low education levels
- being unemployed
- general feelings of hopelessness and frustration.

This leads to situations where self-destructive behaviour occurs [31, 53].

It is important to recognise the enjoyable aspects of VSU that make young people want to try it. Belonging to a petrol sniffing group gives young people, in some Aboriginal communities, excitement and a sense of identity and belonging, in a place where there may not be many other ways to experience this [13, 54]. VSU can also give them a feeling of control and power, particularly in Aboriginal communities where they can gain attention from other community members. It can also make them feel that they have control over their own bodies [8, 48, 55].

When trying to understand alcohol or other drug use among Indigenous young people, one of the main contributing factors is thought to be the disconnection from their culture caused by colonisation and loss. Traditional culture gives community members a strong connection to their land, culture and traditional spirits. It can also be a barrier for young people because traditionally young people are given a lot of freedom to do what they want, which may prevent other community members from challenging them about their substance use. Individuals are allowed to be in control of their own actions. Community members are therefore not likely to interfere in another's personal business (Brady cited in [56]).

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

- social disadvantage
- family problems
- cultural disruption
- degree of community attachment
- lack of physical and human resources
- access to resources and supports
- geographical location and through this, access to substances
- peer groups and local patterns of use [53-55, 57, 58].

Petrol sniffing remains the most common form of VSU by Indigenous people in remote communities and has occurred in some Northern Territory (NT) communities since the 1940s. It is thought to have started when Aboriginal people watched American servicemen inhaling substances during the Second World War [59]. The first official record in 1950, was at the Lee Brothers' sawmill on the

Coburg Peninsula, NT, where it was noted that petrol needed to be locked up [55, 59]. Petrol became a popular drug for many children and teenagers during the 1970s and 80s and by the 1990s as the surviving users grew older, sniffing developed its own culture. Young people in certain areas started wearing distinctive clothing, listening to heavy metal music, and older users started initiating younger sniffers in how to steal petrol and personalise empty beer or soft drink cans [55, 59].

In urban areas, VSU tends to be experimental and doesn't last for long periods among younger people. In remote communities petrol sniffing starts at a younger age and continues for a longer period of time [1, 13]. Most Indigenous petrol sniffers are between eight and 30 years old, and the majority are aged between 12-16 years, although there have been reports of sniffers as young as five years old [8, 10, 56]. VSU usually occurs occasionally or experimentally, but one study has shown that the most common length of use was eight years, which increases the risk of some substance users becoming chronic users as they age [2, 60]. Although, leaded petrol has not been available in Australia since 2002, long-term heavy petrol sniffers use a combination of lead and unleaded fuel which affects their cognitive function [29].

Volatile substances are some of the cheapest methods of intoxication. They are easy to get hold of and easy to use [61].

What are the risks of comorbidity?

There has been little research on the psychological effects of chronic volatile substance use among Indigenous Australians. However, research carried out among other populations suggests that volatile substance users are at an increased risk of more than one mental health disorder occurring at the same time (comorbidity) [62-69]. Inhalant users in other populations have displayed higher rates of major depression, anxiety and personality disorders, as well as both suicidal thoughts and attempts [66-69].

Prevalence - how many people are using volatile substances?

Gathering accurate information about the number of volatile substance users is very difficult because VSU is not against the law in Australia. Record keeping is neither common nor standardised and VSU is often kept secret and hidden [13]. However, there are some

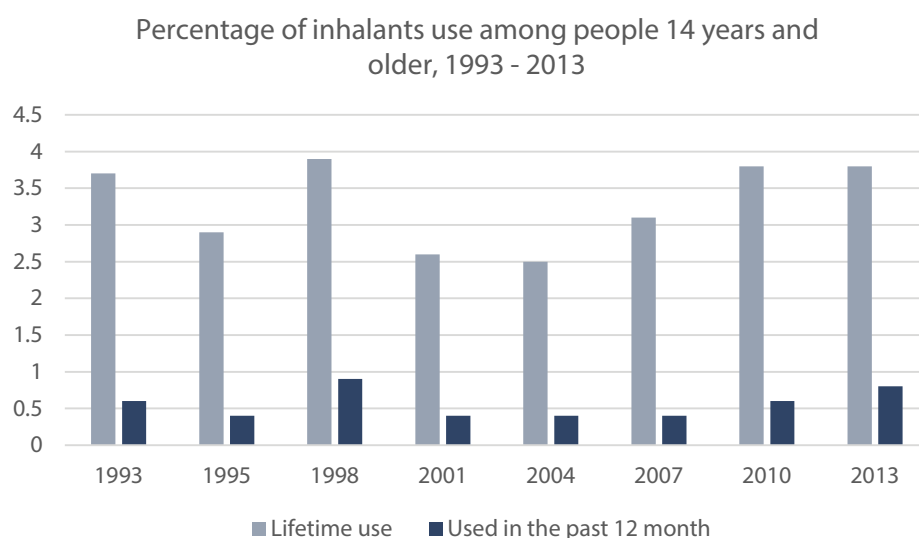
elements of VSU which can be highly visible and cause alarm in communities (for example, when a young person chomps or sniffs petrol in front of adults) [22].

There are two regular surveys about drug use in Australia: the *National drug strategy household survey* (NDSHS) and the *Australian school students' alcohol and drugs* (ASSAD) survey. Both of these surveys are limited in being able to provide accurate estimates of VSU, - information about age, Indigenous status and residence are important in getting the facts correct about VSU, and both surveys have limitations in these areas:

- neither survey breaks down these categories by Indigenous status or remoteness
- neither survey interviewed those who were homeless, institutionalised, or in current treatment [70, 71]
- the ASSAD survey did not examine the VSU prevalence data by Indigenous status
- the ASSAD survey only surveys students attending school.

According to the 2013 NDSHS, inhalants had been used by 0.8% of the population in the last 12 months and, of these, 30% had used them at least once a month or more. Although this indicates a slight increase on 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 (Figure 1) [71].

Figure 1. Percentage of inhalant use among people 14 years and older, by frequency of use and year, Australia, 2013.



Source: AIHW, 2014 [71].

How many people are petrol sniffers?

There is not a lot of data about Indigenous VSU, although there is some that gives insight into petrol sniffing in Aboriginal and Torres Strait Islander communities. In 1985 it was estimated that 35 out of 371 NT communities (about 10%) had experienced problems with petrol sniffing [7]. During this time, VSU was mainly confined to Aboriginal and Torres Strait Islander communities in Arnhem Land and Central Australia [55]. By the late 1990s petrol sniffing was being reported in previously unaffected communities, which included the Katherine region of NT, Cape York in Queensland (Qld), South-West Qld, western New South Wales (NSW) and northern Victoria (Vic).

In 1997, a study carried out in Alice Springs, NT, estimated that there were 60 people inhaling mainly paint [72]. In 2004, approximately 30 communities in the NT were experiencing problems with petrol sniffing with about 350 reported chronic users sniffing constantly [8]. In 2006, there were about 600 reported chronic petrol sniffers across Central Australia [56], of which 75 were living in or visiting Alice Springs town camps [73]. A more extensive survey of petrol sniffing was carried out in 2006-2007, in remote Indigenous communities that had introduced low aromatic (low odour) fuel. It found that just over 1,000 people were currently sniffing in these communities. This was nearly half of the population aged between 5 and 40 years [74].

A 2008 survey of petrol sniffing in the main areas where sniffing takes place, was carried out as part of a low aromatic fuel cost-benefit study. It showed that there were 1,722 petrol sniffers [75]. The areas that the study included are listed in Figure 2. However VSU in Darwin was not included.

A follow-up measure of petrol sniffing is currently being carried out in some of the same communities as in the 2008 study, in order to monitor the ongoing effects of substituting low aromatic Opal fuel for regular fuel. Initial findings from this study indicate that there are 276 current petrol sniffers, mainly located in four of the nine regions [10] in which the communities are located. Remote Indigenous regions included in the analysis are shown in Figure 2. Of the 41 communities included in the current study, 15 have comparable data from 2005 and 2007-2008. Although the total number of current sniffers has fallen, from 546 (in 2008) to 160 (in 2007-2008) to 97 (2011-12), this has not been even across all communities. For example, in communities located in the Goldfields region of WA, the number of sniffers has increased from 30 in 2008 to 51 in 2011-12 [10].

What problems are associated with VSU?

A study of petrol sniffing among the Pitjantjatjara people in 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 [76]. The after-effects of VSU are not restricted to the user, but also effect the families, communities, and the wider society [2, 74]. The problems are listed in Table 2 below. Not all problems occur in all cases and they may simply happen alongside VSU, rather than be caused by it.

Families affected by VSU often feel a sense of shame and a lack of control over their young people, in addition to the emotional and financial hardships they may already be suffering. Parents may feel helpless to stop VSU, although they may be responsible for caring for an increasingly weakened or disabled child [74]. Property crime, violence, family friction, physical and mental health problems and young people committing suicide often occur with VSU [13]. Constantly coping with these problems causes harm to the community, and threatens its unity [8]. VSU also affects the wider

Figure 2. Numbers of petrol sniffers in 15 communities by age group and region, Australia 2005-2012

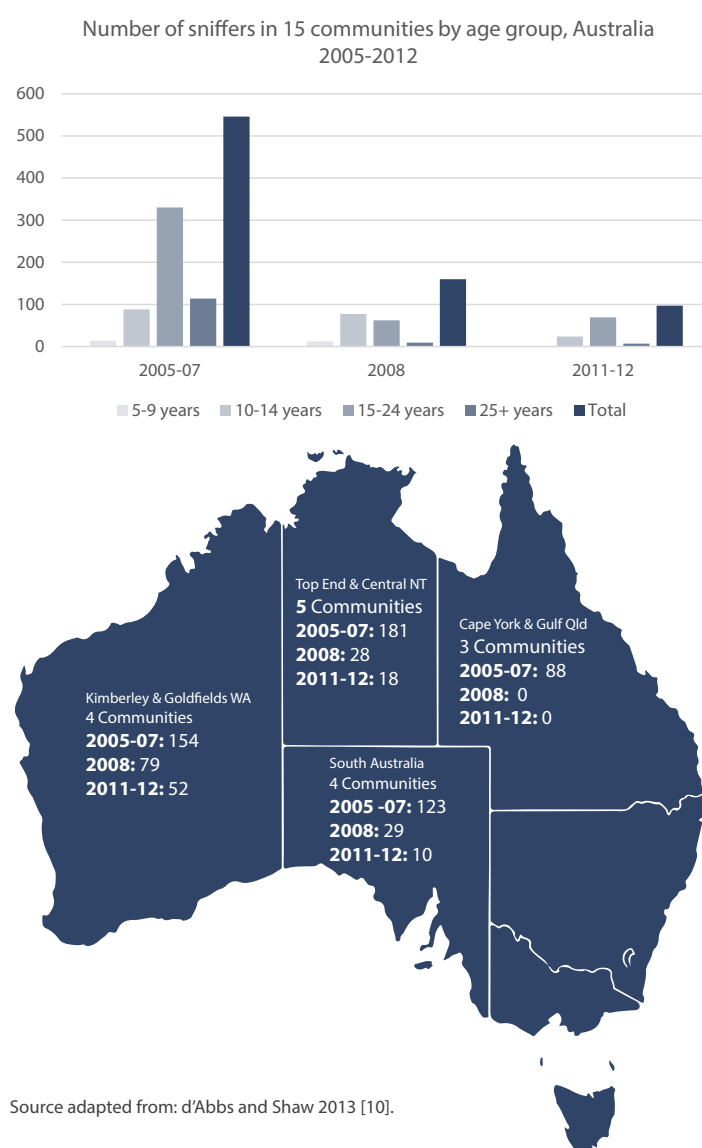


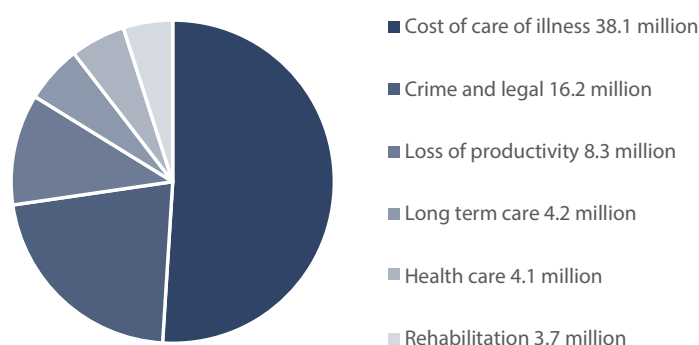
Table 2. Key problems associated with VSU

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	disruption to family life, social stigma
	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: Galanter and Kleber, 2008; Lowinson, 2005 [18, 19]

Figure 4. The cost of petrol sniffing in Central Australia 2005

Total sum of yearly cost of petrol sniffing in Central Australia 2005 \$78.9 million



Source adapted from: Access Economics (2006) [77]

Australian community in terms of lost work time, and the need for interventions by various government services.

In 2005, the total sum of the yearly cost of petrol sniffing in Central Australia was \$78.9 million [77]. The various components of the cost are shown in Figure 4.

Over \$80 million has been spent by the Commonwealth on resources as a part of the *Petrol sniffing strategy* (PSS) since 2004-05, including \$42 million spent on low aromatic fuel (LAF) [9]. Since 2004, another \$213 million has been spent from program and funding sources to support petrol sniffing programs and address the basic problems of VSU [9].

A cost benefit analysis of mandating low aromatic fuel use calculated the long-term costs of sniffing within the 'analysis zone' of major sniffing areas (excluding Darwin) in 2010 [75]. 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, mainly in the form of morbidity, mortality, and loss of earnings. The other costs were connected with costs to government (\$471 million), and costs to the communities in which sniffers live (\$223 million).

How much sickness and death is caused by VSU?

There is no current regular collection of information in Australia at a state, territory or national level associated with mortality (death) or morbidity (sickness) from VSU. People who use volatile substances usually seek medical help for illnesses or injuries caused by VSU. Therefore, records usually only record the illness or injury they wanted treatment for. In the case of deaths, the rule is to list the medical reason for the death, not the volatile substance that may have caused it. For example the cause of death of a chronic petrol sniffer will usually be recorded as suffocation, car accident or suicide, rather than petrol sniffing [47].

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 showed that VSU was given as the main drug problem in 726 people (1.5%) having treatment delivered by specialist alcohol and drug services [78]. In the same year, 35 people using volatile substances had to spend time in hospital resulting in 214 bed stays. In WA, between 1994 and 2000, there was an average of 32 VSU related hospital admissions per year [1].

Petrol sniffing has been identified as a risk factor for six medical conditions. Therefore, hospital admission data on these six conditions can be used to calculate the number of admissions due to petrol sniffing (this is called the 'aetiological fraction methodology' [75]).

The six medical conditions are:

- lymph node leukaemia
- bone marrow leukaemia
- mental and behavioural disorders
- poisoning effects of organic solvents
- poisoning affecting brain function
- accidental poisoning by and exposure to solvents.

In 2007-08 there were 282 Indigenous hospital admissions for these six conditions, and the calculation shows that just over a quarter (77 cases or 27%) can be attributed to petrol sniffing [75].

A national study between 1980 and 1987 identified 121 deaths from VSU, 17 of these were connected to petrol sniffing [79]. At this time petrol contained lead, suggesting that there was more chance of neurological damage and death. More recently, mortality data have been collected in Victoria [47]. Coronial files (from the Coroner's office) indicated that between 1991 and 2000, 44 deaths were associated with VSU. Neither of these reports has published information related to Indigenous status.

Information gathered at the regional level on mortality associated with petrol sniffing, shows that in all cases those who died were Indigenous [13, 58]. Coronial and other evidence were used to estimate that 63 Indigenous people died from causes related to petrol sniffing between 1981 and 1991:

- 42 deaths were from desert communities on the border between WA and SA [58]
- 12 deaths were from communities in the Goldfields region of WA
- 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 found 37 petrol sniffing deaths between 1998 and 2003. The location of these deaths is provided in Table 3.

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, however, deaths increased in the central area of the NT and in the East Kimberley region of WA [13, 58]. The immediate causes of these petrol sniffing deaths are listed in Table 4.

Table 3. Numbers of deaths from petrol sniffing, by region, Australia 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 [58].

Table 4. 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 [75].

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

What is supply reduction?

Supply reduction strategies are plans designed to reduce the amount of volatile substances available for access. The strategies target accessibility (how easy it is to get), affordability (how much it costs) and availability. There are four supply reduction methods designed to address VSU:

- product modification strategies
- restriction of physical access to substances
- mandatory sales restrictions
- voluntary sales restrictions [13].

What is product modification?

Some strategies have attempted to prevent VSU by modifying the substances, including:

- changing packaging to restrict use
- adding deterrent chemicals (chemicals that discourage use)
- replacing or removing the toxic or psychoactive components to reduce the harms associated with their use.

Modifying the packaging of volatile substances to stop their use for intoxication has little support in the literature [13]. Modifying the nozzles of aerosol cans was trialled in the UK, but determined users were able to inhale the propellants by puncturing the can or by removing the nozzle [47].

Adding deterrent chemicals to substances is a possible option, and does not negatively affect normal users of the product. Four Indigenous communities added ethyl mercaptan (a chemical compound with an offensive smell) to petrol. The strong smell 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
- 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 [58, 61].

The most effective product modification strategy has been the replacement of harmful and psychoactive chemicals with mild alternatives [80]. Research in the UK has shown that reducing the

intoxicating components by changing the product's make-up has been associated with reduced VSU- related deaths [81]. In Australia, leaded petrol was nationally phased out on 1 January 2002, due to the health risks [82]. 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 no longer requiring hospitalisation for lead encephalopathy or seizures [58].

Introduction of reduced-toxicity spray paints

The introduction of reduced-toxicity spray paints was initially driven by the paint industry. Their aim was to remove the aerosol propellants in the cans, because of the negative impact on the environment. This unintentionally resulted in a product that produced fewer aromatic hydrocarbons, and little intoxication when inhaled [83, 84]. 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 [84].

Toluene (a colourless liquid hydrocarbon present in tar and petrol), and xylene (a volatile liquid hydrocarbon from distilling wood, coal tar or petrol), were both used in toxic spray paints. These two chemicals have both since been removed from spray paints, which has stopped the intoxicating effects associated with chroming. The paints are lead-free, produced in recyclable cans, and do not contribute any CFC (chlorofluorocarbon) damage to the ozone layer [84]. Their rollout has been linked to a reduction in 'suspicious' sales at Alice Springs retail outlets [85].

Introduction of low aromatic fuel (LAF)

From 1998 to 2005 aviation fuel (Avgas) was used in remote communities in WA, SA and the NT because it contained fewer hydrocarbons and produced less of an enjoyable effect for sniffers than leaded or unleaded petrol. The Australian Government subsidised the cost of Avgas through the COMGAS scheme. It was available in 36 communities by the end of 2004. The inhalation of Avgas caused severe headaches and stomach pains due to high quantities of tetraethyl lead present, and this helped stop further sniffing [77, 86].

By 2005, changes in the production 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 low aromatic fuel (LAF) as a replacement for Avgas. LAF production and distribution was funded by the Federal Government, and in 2006 it was the most commonly used unleaded fuel across Central Australia [77, 87].

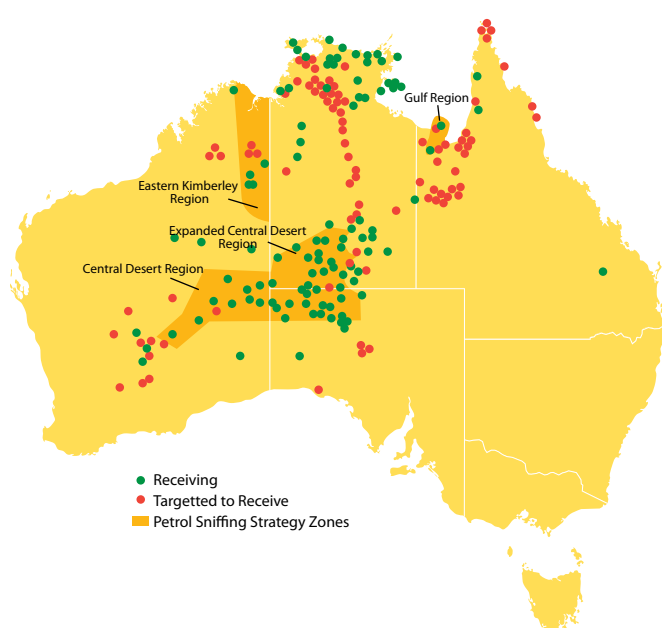
The supply of LAF rapidly expanded up until 2007-08 and then stabilised. As of 2012, LAF was being delivered to 123 sites throughout Australia, although use has declined slightly since 2008-09 [9] (Figure 5, 6).

Following the introduction of LAF, there has been a huge reduction in petrol sniffing across Central Australia, which has largely been credited to LAF [10, 13, 88]. The initial rollout and use of LAF was linked with various difficulties, which may have had an impact on its long-term success (e.g. poor communication at the time of the initial rollout, which led to the spread of false information about LAF's effect on cars [5]).

Following the initial introduction of LAF in 2005, the Australian Government expanded its commitment to preventing petrol sniffing through an 'Eight point plan', by gathering the support of the WA, SA and NT Governments. The *Eight point plan* later became the foundation of the *Petrol sniffing strategy* (PSS). It was a combined and complete approach to addressing petrol sniffing, targeting the cause as well as the practice of sniffing [9]. The eight points were:

1. consistent laws with penalties for offences relating to the sale or supply of volatile substances for sniffing
2. proper levels of policing
3. further roll-out of LAF
4. development of activities for young people to divert them from using substances
5. supply of treatment and respite facilities

Figure 5. LAF delivery sites at February 2012



Source: Marcus and Shaw 2013 [9].

6. development of communication and education strategies
7. strengthening and supporting communities
8. evaluation of interventions.

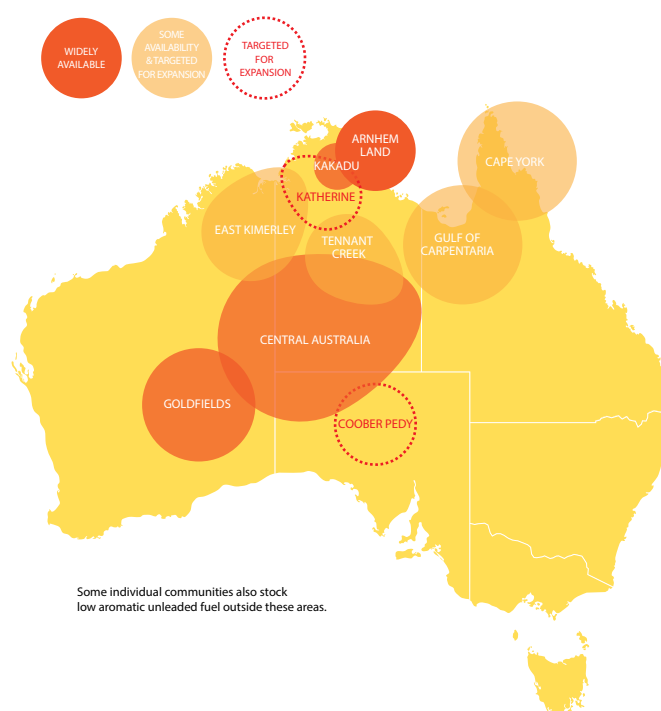
The PSS aimed to reduce the rate and number of cases of petrol sniffing within the PSS zones (Figure 7). They aimed to address all aspects involved with petrol sniffing by:

- reducing the effect of sniffing on individuals, families and communities in the PSS zones
- evaluating the effectiveness of a broad response to petrol sniffing
- determining whether it can be usefully adapted in other regions [9].

Although LAF was first only delivered to communities inside the PSS zone (Figure 6) it was later provided to communities outside the zone where petrol sniffing was also occurring. This came about because access to regular unleaded petrol from the communities outside the zone was impacting petrol sniffing inside the zone [9].

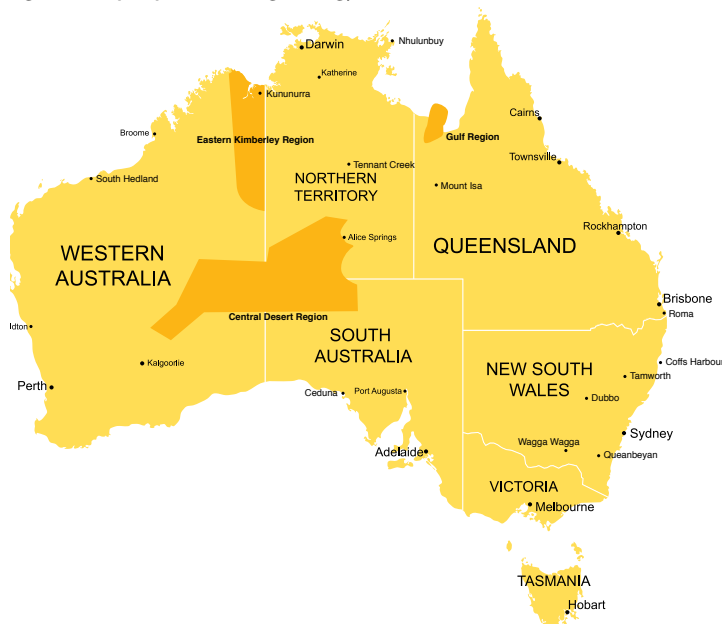
BP Australia Pty Ltd supported the initial development and production of LAF. In December 2012, the Australian Government announced that Shell Australia would commence production of LAF starting in late 2013. BP would supply LAF to Central and South Australia, and parts of WA, while Shell would be the main supplier of LAF to the Top End, the Gulf of Carpentaria, Cape York and East Kimberley [11].

Figure 6. Availability of LAF



Source: Department of the Prime Minister and Cabinet 2015 [89].

Figure 7. Map of petrol sniffing strategy zones



Source: Department of Families, Housing, Community Services and Indigenous Affairs, 18 October 2012, cited in [9].

The switch from unleaded petrol to LAF relies on petrol stations and roadhouses choosing to replace their unleaded fuel with LAF. Since the rollout of LAF, there has been disagreement about whether the stocking of LAF should be mandated (made law) by governments, particularly with shop owners in areas of high VSU use who refuse to stock it [4, 9]. A 2010 study that looked at the cost effectiveness of the change to LAF in regions of Central Australia, concluded that the Opal rollout had been a help in reducing sniffing and that the community benefits of authorised 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 thorough rollout of LAF [75].

The 2013 *Evaluation of the PSS* [9] report stated that the Australian Government suggested they would support laws to permit the supply of LAF in certain areas. This would allow the Minister to select specific areas as either:

- ‘fuel control areas’, where storage and supply of other petrol including premium unleaded would be restricted
- or ‘low aromatic fuel areas’, where only LAF would be available [9].

The 2013 *Evaluation of the PSS* suggested that the LAF area would likely grow larger and would need agencies to have important discussions to bring together the delivery of services that support and improve the effect of LAF [9]. The lack of storage facilities for LAF in northern Australia was related to complex petrol sniffing across the Top End of the NT [9], restricting the complete rollout

of LAF [75]. 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 [90]. The tank was completed and launched in February 2015 [91].

LAF has largely replaced standard unleaded fuel in Alice Springs and across Central Australia, although aromatic premium fuel is still available in Alice Springs and at some roadhouses. In 2008, it was calculated that the use of premium unleaded fuel usage grew from 10% prior to the introduction of LAF to 50% [92], which may point to community mistrust towards LAF [4]. Another reason for the increase in the usage of premium unleaded may be due to the high turnover of tourist population in places such as Alice Springs, who are unfamiliar with LAF and its purpose. It may also be due to 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 Government Senate Inquiry into the impact of LAF suggested that, should the retailer guidelines for selling premium unleaded fuel be limited, serious consideration be given to a government funded low aromatic premium fuel substitute [4]. In response, however, the Government recorded that development of a low aromatic premium fuel was not being considered. 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 effect of LAF is clear. A 2008 evaluation found a 94% reduction in petrol sniffing across Central Australia following the rollout of LAF [88]. 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 importance of LAF in the reduction of sniffing [88].

Although the rollout of LAF has had a critical effect on petrol sniffing in major areas across Australia, the change is only one element in addressing substance use [4], and is not a total solution to the problem. The introduction of LAF needs to occur in partnership with a range of other strategies which address the root causes of the problem, such as hidden social and educational disadvantage [5]. Introducing LAF in some areas without providing access to youth or community services at the same time means that demand reduction or diversionary strategies have not always been put in place to support the effect of LAF [9, 88].

How do we restrict physical access to volatile substances?

The difficulty in controlling VSU is that volatile substances are not, in themselves, illegal. They provide an important function to most of the population. Banning the use of volatile substances is therefore not a possible or practical choice. However, tighter management and control of some volatile substances is possible.

The method of physically preventing access to substances has been tried in almost every location where petrol sniffing has been a problem [13]. These methods have included:

- enclosing petrol pumps with cages
- employing guard dogs
- flood-lighting petrol stations and other petrol housing facilities.

However, none of these methods has proved completely effective [58, 61]. 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. This shows how these methods simply force users into finding different access to substances [58]. Of course, the failure of these methods to completely wipe out VSU does not mean that substances should be left unlocked, but rather, that control of access is not enough on its own [13].

What statutory restrictions on sales exist?

Evidence suggests that the regulations to restrict volatile substance availability have reduced VSU. Information from the UK in the past showed that, when measures were introduced to restrict the sale of certain glues, users switched to more dangerous products, such as butane and aerosols [93]. Other evidence however, has reported that restricting sales of lighter refills to those under 18 years lowers deaths in this age group [81].

Most Australian states and territories have rules that prohibit the sale or supply of volatile substances to a person who can be expected to use them as an intoxicant. In 2013, the Federal *Low aromatic fuel act* was introduced, which placed further limits 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). However, there have been difficulties in enforcing this type of legislation. The decision-making of some retailers (shop keepers) has been driven by worries that refusing sales to Indigenous people could be misread as racial injustice and could leave them liable to charges [94]. Other states have limited the sale of volatile substances to individuals aged under 18 years [13] - 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. As of 2007, South Australian retailers must keep a record of volatile product sales. NSW and Qld have also limited the sale of spray paints to those aged less than 18 years.

What voluntary restrictions on sales exist?

Several local programs have attempted to lower supply through willing agreements with retailers [94, 95]. Despite the lack of evaluations, the limited information available suggests that telling retailers to lock up volatile substances and usable products, such as spray paints, markers and glues, and retailers refusing sales to those suspected of misusing the substance, works well when introduced through a process involving community development and retailer education [85]. An Alice Springs retailer education network is an example of this approach, where 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 rules that made it an offence to knowingly supply volatile substances to those who will use them for VSU [85, 95, 96]. 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.

What legislation (regulations) exist?

Under the *Eight point plan*, there was a move towards developing consistent regulations for addressing VSU across all Australian states and territories, although the purpose was never clearly understood [9]. A fixed legal framework would recognise the importance of law enforcement in responding to VSU, and provide the assistance of legal systems for families and communities to help young people stop sniffing, without criminal penalties. In the NT the introduction of the *Volatile substance abuse prevention act* (NTVSAPA) 2005 aimed to provide police and service providers with special powers and responsibilities when faced with the use of easy-to-access substances, and may have served as a motivation for the drive for legislative organisation [9].

Legislation across Australia varies between states and territories. A recent study conducted in 2008 examined different legislative approaches to pass laws for petrol sniffing and VSU. Specifically, it addressed:

- description 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
- forced treatment of chronic substance users
- involvement of Aboriginal communities in the management of sniffing [9].

A second study conducted in 2010 examined existing legislation relating to petrol sniffing, in territories where the PSS was being carried out - WA, SA, NT and Qld [9] - to examine the effectiveness of different legal frameworks across districts. The study found that:

- there were no negative effects caused by differences between existing frameworks that needed addressing by the introduction of consistent legislation
- although most of the stakeholders were satisfied with the legislative tools available to them, none of them was forcing people into treatment because of the lack of available services where petrol sniffers could be sent
- stakeholders recognised the need for legislative frameworks as basic tools in the response to VSU
- stakeholders identified two main factors as critical to the success and ongoing reduction of VSU in communities:
 - methods to reduce the supply of volatile substances
 - access to good quality services such as rehabilitation and diversionary programs [97].

Achieving legislative agreement was not found to be of greatest importance, there has been some confusion about VSU lawmaking. This involves:

- confusion about the legal framework
- differing opinions about the ability of the police to become involved
- no clear descriptions of treatment and respite services to which volatile substances users can be forced to go to
- lack of resources
- confusion about the ability of community services or police to become involved when people are known to be misusing substances, but not breaking the law [9, 97].

The NTVSAPA, which is one of the most comprehensive legislative answers 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.

Community management plans allow communities to control the possession, supply and use of volatile substance within a chosen space within communities. Once approved by the Minister, communities can prohibit petrol and paint from entering into the community. This is legally enforced 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 approve community plans, and changing plans needs 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 legally enforce 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 naming 'low aromatic fuel areas' or 'fuel control areas', with specific rules controlling the supply, transport and possession of petrol within those areas. Low aromatic fuel areas and fuel control areas can only be chosen by the Minister of Health after meeting 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, rules can be made concerning:

- banning the sale of regular unleaded petrol
- promoting and recording the supply of LAF
- controlling the supply and storage of other fuels, in particular premium unleaded petrol [11].

Once controls under the *Low aromatic fuel act* are put in place, it is an offence to break them, but they only apply to businesses recorded as corporations. As such, they do not apply to people travelling through a low aromatic or fuel control area [11].

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

What is 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 important in tackling VSU, it is unlikely to be completely successful on its own. Demand reduction methods, which have the power to address the hidden causes of VSU, are also needed. Useful methods are likely to include a focus on the social elements 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 decline. Wiping it out is unlikely to be achieved without long-term commitment to providing infrastructure (buildings, services etc. required to properly support a community) in communities at risk [98].

Community-based approaches

There is a large body of literature on community-based approaches to VSU, in both urban and remote settings. Several of these are outlined below, and more details are provided in *Volatile substance misuse: a review of interventions* [13].

Healthy Aboriginal life team (HALT)

The *Healthy Aboriginal life team* (HALT) was an early example of a community-based petrol sniffing prevention program [99]. HALT was based on cooperation rather than control, and aimed to work with extended Aboriginal families to help them recover their power to resolve problems. In the case of petrol sniffers, it wanted to link sniffers back into their family networks and systems and promote the protective and controlling ability of those networks and systems. Counselling and education were used to permit communities and families to come to view petrol sniffing as a problem which could be fixed by families.

HALT had limited success with its original host community of Yuendumu, but when the model was tested throughout the APY Lands it failed to have an effect [100]. This suggested that the traditional counselling and community development approaches can be effective in reducing petrol sniffing if used with skill, cultural sensitivity and community support, but the program was not easily transferable to other communities. Other reviews of HALT have expressed concern over its uncritical acceptance of restoring cultural ways as effective prevention, and its dependence on traditional child-rearing practices, which may have discouraged parents from disciplining petrol sniffers [101, 102].

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:

- replacing Avgas for normal petrol
- removal of petrol sniffers to outstations to help 'break' their behaviour and give some respite to communities
- providing positive options in communities, such as youth and recreational activities and employment [13].

Despite its brief existence, two of these strategies - substitution of petrol with Avgas, and outstation programs - have formed part of the vital response to petrol sniffing in Australia [13].

The Central Australian youth link up service (CAYLUS)

The *Central Australian youth link up service* (CAYLUS) is an Alice Springs based program that was started in 2002. CAYLUS was involved in the first rollout of LAF across Central Australia, pushing for LAF on behalf of communities. CAYLUS achieved this by supporting relationships with Government and convincing them that LAF was a practical and mechanically safe substitute 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 pressing for LAF [96].

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 application 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 comprehensive, and focuses on the need for community support, connections and empowerment. CAYLUS encourages communities to play active roles in the response to VSU [85, 96, 103]. In a recent partial 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 actually care about young people [104]. 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 [105]. 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 start in 1999, there have been three formal program evaluations [105-107] which not only affirmed the continuing need for the program, but also identified strengths of the program that could possibly be useful for other substance use programs:

- employment of well-trained staff
- providing 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
- providing training, support and resources for community workers
- clearly outlined project targets and performance indicators
- awareness of Aboriginal cultures and broader implications for the project.

These elements were critical to the success of the *Makin' tracks* program, which delivered training to each community, depending on their particular need [108]. Despite the program's major impact since it started in 1999 [105-107], funding stopped 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. It was formed in 2002 in response to an increase in local inhalant use [109]. The group was organised 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 [109]. A project officer was employed to coordinate responses to VSU. The CIAG put into effect 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
- tracking of changes in presence of VSU
- providing education and support for communities and families about responding to VSU
- requesting improvements of service responses for people who use volatile substances.

Since the formation of CIAG, VSU in Cairns has greatly reduced, to the point where the group reduced its meetings from monthly to twice a year [110].

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 [58, 111]. They were first developed as an answer to the 1991 *Royal commission into Aboriginal deaths in custody*, and were first operated by the Aboriginal and Torres Strait Islander Commission.

Community patrols are designed to step in 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 [112].

Successful patrols operate independently from, but in close collaboration with the police and with their support [113].

Their success is mainly due to having:

- high levels of community ownership and drive;
- volunteer staff members
- wide community discussions at program outset
- duties of patrollers that are well set out
- a strong management structure in place [114-116].

Although community patrols are vital in terms of giving power to communities and often have widespread community support

[117], 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 [118]. 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 [118].

Although community intention and determination to combat petrol sniffing and VSU is critical, it may not be enough to develop effective and continuous interventions [119]. Elements of community-based support have been included into the NT's *Volatile substance abuse prevention act* (NTVSAPA) 2005. This has allowed communities to set up community management plans. These plans allow remote communities an element of control over their communities and policing practices. They make it possible for individual communities to ban petrol and paint, and to control the supply and sale of petrol and paint within their council area [73]. Once approved by the NT Ministry, community management plans can be legally enforced by the police.

Strong communities are an important part of the response to VSU [13, 120], with evidence pointing to the need to promote the development of the community's ability to tackle the problem alongside service provision [13].

Drug education and VSU management

Drug education and VSU management strategies aim to:

- prevent people starting VSU
- help users quit
- assist with safe use practices of people who choose to continue misusing volatile substances
- provide health care workers with the necessary resources to effectively manage VSU [121].

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 [13, 121].

Specific methods include school and peer education workshops or programs, fact sheets, posters, community radio and newspapers, mentoring programs and therapy [121].

Education programs targeted towards those who may be at-risk of becoming involved in VSU can be effective in communicating risk-related information. However, there have been concerns raised by healthcare workers and community members that providing VSU information could lead to young people experimenting with these substances [13, 121]. The basic reason for restricting VSU education in schools is that students are unaware of their ability to be misused. However, evidence from the UK indicates that three-quarters of 11-14 year-olds are aware of inhalants and sniffing [47]. It is unclear what number of young Australians are aware of VSU, and there is a lack of information available to young people in schools and the media about the possible misuse. This could 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 relevant when communities experience clusters of VSU [122], which requires an immediate response, including education and information for the community [121].

The concern that providing VSU information to young people could draw their attention to the practice and lead to experimentation is reflected in Australian national and state school education policies (guidelines) and strategies, which do not include VSU [123, 124]. Although the reason behind these policy approaches is argued to be evidence-based [1, 124-127], there is no clear description of, or reference to, the primary research study that supports these arguments. The only reference in these policy documents to any research based on actual data is a New Zealand study, which appears to support the Australian behavioural management position, rather than provide any documented support [128].

One Australian VSU education policy developed by the Victorian Department of Education and Training, claims (without providing supporting evidence) that young Victorians have lower rates of VSU and VSU-related mortality than are related to other substances, and used the information as a satisfactory reason for not including VSU in school-based drug education [124]. However, the 1996 *Australian secondary schools alcohol and drug survey*, which was the study conducted immediately before the publication of the

Victorian resource, found that 24% of Victorian school students reported they had deliberately inhaled a volatile substance [129]. This percentage of use by students, although lower than for the use of alcohol (80%), tobacco (65%) and cannabis (35%), was still higher than for use of sedatives (18%), hallucinogens (7%), amphetamines (5%), opiates (3%), cocaine (3%), and ecstasy (3%) [129].

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. This strategy is focused on reducing or preventing further harms, and preventing the delay of first use [123, 130]. The opposite approach is taken in the UK and in parts of the USA, where it is included in mainstream drug education. Research from the UK in 1994 argued that providing early education to young people about VSU was important, due to widespread awareness and availability of volatile substances [131]. Education and media campaigns were launched in the UK in response to the rising number of deaths of young people caused by VSU. These campaigns focused on educating parents, via the media and in schools, about the possible misuse of domestic products [47]. Rather than resulting in a rise in VSU, the campaigns were surprisingly successful, and were believed to be responsible for the halving of death rates [81].

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 [132, 133]. Only two trials were identified by Foxcroft and Tsertsvadze's 2012 Cochrane review, which examined universal prevention programs within schools [134, 135]. Neither of these showed harmful effects on the use of inhalants among school students [132].

Whether or not to include education in schools about alcohol or other drug use, including VSU seems to be a key consideration. It is receiving increasing attention in writing and reports about this subject, and is the focus of current evidence-based trials. Research into the use of alcohol and other drugs among young people has seen that the typical age of starting use is 15-24 years. This early use of substances, including inhalants, is a risk factor for the later development of substance use disorders [136, 137]. Recent research on school-based programs that aim to prevent the use of alcohol and other drugs suggests that reducing risk factors and improving protective factors to promote resistance show the most promise for effective prevention [138]. These should be evidence-based, designed in agreement with best-practice research, and introduced during early adolescent years [136, 139]. Ideally, prevention programs should be delivered before the initial exposure to alcohol or other drugs, and allow for the development of knowledge and skills for young people to make responsible

decisions regarding substance use [136].

Although there is an increasingly large evidence-base that supports alcohol and other drug education programs in schools [123, 136, 138, 140], until recently, there has been a lack of long term research examining the impact of school-based drug education in Australia [130]. Addressing this important need however, is an ongoing randomised controlled trial (that is, a study in which people are chosen at random to receive one of several clinical interventions) of a universal prevention Internet-based program, *Climate schools: alcohol and cannabis course*, based on harm minimisation [141-143]. The *Climate schools program* is promoted over the Internet, which guarantees consistent program delivery, and uses cartoons and engaging storylines to hold students' interest throughout the program. It is designed to be delivered to students in Year 8 (13-14 years of age) before considerable 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 proved that compared to students receiving usual drug education delivered in health class, students receiving the *Climate schools program* showed notable improvements in alcohol and cannabis knowledge after six and 12 months. Furthermore, in terms of changes in behaviour, students who received the intervention displayed 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 [142, 143].

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 only just starting, programs based on community support and discussions have been developed [140]. An Aboriginal and Torres Strait Islander alternative to the *MAKINGtheLINK* program was developed in 2012, 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 wanted to promote health seeking in regards to cannabis, alcohol, tobacco and inhalant use. The program was developed in discussions with a reference group of teachers, Aboriginal and Torres Strait Islander Elders and community members, and was focus tested on Aboriginal and Torres Strait Islander primary and high school students [140].

Cultural approaches

A number of ground-breaking programs have been developed using Aboriginal and Torres Strait Islander cultural practices as ways for addressing VSU. These programs have used elements of art, storytelling, and rebuilding of important caring relationships to understand the problem of petrol sniffing in Aboriginal and Torres Strait Islander frameworks [87, 144].

The *Sniffing and the brain flipchart* was developed by Cairney and Fitz [144], and is an example of a resource that uses images and stories with identifiable cultural links to assist health and community workers explain to Aboriginal and Torres Strait Islander audiences the effects of petrol sniffing on the body. The evaluation of the flipchart found that it was viewed positively by stakeholders. This highlighted that the storytelling format and use of images to explain the effects of petrol sniffing on the brain made it an effective tool for spreading information [145].

A resource kit, *Petrol sniffing and other solvents*, was published by the Aboriginal Drug and Alcohol Council (ADAC) of SA in 2000 [87]. 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 Aboriginal and Torres Strait Islander communities if they were designed specifically for their use, and contained flipcharts, and interactive components such as games, videos, and a CD in the local language [87].

The shortage of evaluations into cultural interventions makes it difficult to determine their overall effectiveness. Such interventions offer the possibility of influence ways in which people think about VSU by using views to be found within Aboriginal and Torres Strait Islander culture, as well as highlighting and supporting the traditional ability to deal with the problem through family and community care.

Using scare tactics is not effective in drug education for young people. Providing information based on the immediate needs and proprieties of users have been shown to be more influential [2, 13, 47, 146]. In regards to what represents important information for young Aboriginal and Torres Strait Islander volatile substance users, interviews with current and reformed petrol sniffers from Maningrida suggested that neurological effects (such as reduced coordination) worried petrol sniffers, particularly when such damage 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 results of more intensive or longer-term use [147]. 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 labelling users
- elements that have promoted the reconnection with culture
- community involvement and active participation
- providing other educational opportunities
- the development of work skills
- an assorted range of activities
- flexibility to suit local lifestyles [13, 56].

Treatment and respite facilities

The evidence base on the treatment and management of VSU is limited, and what does exist usually indicates a poor response to traditional substance use treatment approaches [148]. More than 80% of the 550 respondents to a survey of drug treatment practitioners in Canada assessed their volatile substance misusing clients' chances of recovery as 'poor' or 'very poor'. However, a recent case-by-case review of interventions for VSU identified that Indigenous residential programs show promising outcomes [149].

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 effectiveness of this form of intervention [1, 150]. Since 2008 the Australian Department of Health (DoH) has spent an estimated \$4 million on treatment services for petrol sniffing, mainly in the NT [9]. 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 lengthy delays and problems linked with accessing these services for volatile substance users outside the NT [9]. To complicate matters, there is a lack of general agreement among stakeholders about:

- the meaning of 'treatment'
- related advantages of residential services
- intensive case management
- the role of medication management
- treatment for experimental users
- providing culturally appropriate and safe treatment [9].

BushMob house

BushMob is a small treatment centre located in Alice Springs, which has the space to care for up to 20 people in-house at a time [151]. Funded by the NT Government, BushMob takes clients with

a range of issues including those ordered under the NTVSAPA [9]. BushMob provide treatment and stability for young people, aged primarily between 12 and 18 years, who are experiencing problems with sniffing or other drugs. They also have the room to provide accommodation for carers in addition to young people [96]. Their approach is to bring the situation under control, then treat it, and they provide client services such as food, medical attention, and living conditions [96]. Rather than providing thrill-seeking and action-packed activities that may compete with VSU [13], BushMob run outreach programs that are designed to give substance users 'time out' from whatever problems they face in their daily lives [96]. 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 [96]. As such, while BushMob accepts people ordered 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 they have been legally ordered to stay.

Homelands programs

Homelands, or Outstation programs, have been seen as a helpful response to VSU in Indigenous communities in two primary ways:

1. as prevention as families who move to outstations are less likely to face substance use problems
2. as a remedy for users to break from misusing and have the opportunity to become involved in other activities [13].

Mt Theo, Yuendumu

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

- providing exciting distracting activities in the Yuendumu community during 'prime sniffing time', such as weekends, after school, nights and school holidays [152 p.292], 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 decided on by community Elder's assessment of whether that individual was able to return to the community [152, 153]. These efforts had the effect of stopping

individuals from being able to use substances, due to a total lack of supply, as well as keeping them from participating in the enlisting 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 the established petrol sniffing culture [152]. Whereas sniffing petrol was once the cool thing to do for teenagers in Yuendumu, and sniffing houses were the places to go to chat up girls, the Mt Theo program changed the deep-rooted culture, so sniffing in Yuendumu became an insignificant activity that young people wanted no part of [96, 152].

In the last decade, the program has expanded to include new elements including:

- diversion
- treatment
- aftercare
- mentoring
- youth development.

Some of these services now extend to other Warlpiri communities [153, 154]. 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 [96].

Development of volatile substance use clinical practice guidelines

The lack of precise guidelines for health staff to assist with the identification and management of VSU was identified as a part of the PSS. DoH funded the Australian National Health and Medical Research Council (NH&MRC) to develop clinical practice guidelines specifically for VSU. The guidelines were released in late 2011 and provide health workers with information to assist with the identification, assessment and management of people who use volatile substances in urban and remote areas [9, 121]. 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
- allied mental health workers.

They are evidence-based and applicable in primary health, emergency, mental health, and alcohol and other drug service settings.

What is Chelation therapy?

Chelation therapy is a chemical process in which a synthetic (manmade) solution is injected into the bloodstream to remove heavy metal and/or minerals from the body. It is the most commonly used treatment for lead poisoning, and reduces symptom severity and lead levels. 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 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 [26, 29, 32].

Although chelation therapy has been linked with improvements in lead encephalopathy arising from chronic petrol sniffing, long-term neurological damage is often permanent due to the fact that chelating agents (in the injected solution) are not able to bind with all compounds contained in leaded products, in order to remove them [155-157]. Increasing exposure to leaded petrol has been linked with major neurological dysfunction that is still evident years after hospitalisation. Lead encephalopathy is characterised by decreased consciousness, tremors, severe motor impairment (inability to move properly) and convulsive seizures (fits). Emergency hospitalisation is often required, followed by long-term in-patient intensive care treatment [32]. 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.

What is harm minimisation?

Although the broad aim of many approaches is to control, prohibit or prevent behaviours from occurring, harm minimisation aims to reduce the related harms. Harm minimisation is based on the understanding that dangerous behaviours will occur. When preventative, prohibitive and cooperative 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 rules, interventions or penalties. Often, policies related to

health issues are dependent on what is politically achievable, rather than what is politically ideal. This is obvious from the public demand for criminal punishment for drug users and sellers when, from a criminological point of view, confrontational 'lock-em-up' approaches are ineffective [158].

On the whole, Australia has demonstrated a commitment to approaching substance use from a harm minimisation point of view, and turning harm reduction strategies into drug policy [159]. A harm minimisation approach to VSU may depend on the substance and the setting. Petrol sniffing in Aboriginal and Torres Strait Islander communities is basically seen 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 viewed as a crime prevention issue [160].

In regards to VSU, the risk of serious outcomes, including death, highlights the need for making users aware of harm reduction benefits. Such choices have rarely been featured in previous responses to VSU because strategies, particularly supervised use, may trigger 'moral panic' - a feeling of fear spread among a large number of people that some evil threatens the well-being of society [161].

Perhaps less controversial than promoting 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 [123, 162]. 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 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 giving a high priority to 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 [58, 111]. 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 [158].

Law enforcement

Although in Australia it is generally accepted that VSU is a health and welfare rather than criminal justice issue, there has been opposition by some police officers, policy and community agencies about whether VSU is, or should be, a police matter or public health issue [15, 61]. VSU is not a criminal offence anywhere in Australia, but poses an important 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, whilst 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 [16]. Without police support, however, the burden for responding to VSU is placed on health and welfare agencies, who can find it difficult to intervene [96].

Although VSU is not a crime, some Australian authorities have increased police powers to intervene in cases involving VSU, and others have passed laws for police to be actively involved in managing the response. A Qld evaluation of police powers found that amended police powers had served a useful role, but there was an impression that police had been given the primary responsibility for responding to VSU and therefore, health and welfare agencies did not often follow-up with cases of VSU [163].

Another study conducted in 2006 examining police attitudes towards VSU, found a large 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 [15].

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, capturing people, and

recommending assessments for legally enforced treatment orders under the NTVSAPA [15].

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. communicate with health and other community workers [15].

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 regulations
- 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 [9].

Police involvement in an advisory role, 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 proven the important role that industry can play in fighting 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 application of coordinated strategies addressing the supply, demand and some harms of VSU, has led to a large 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 outlined a slight overall increase in use since 2010 [71].

There are further opportunities for improvement as the focus of treatment programs has been on the direct cause of use, rather than the underlying causes of VSU and other destructive health behaviours. The most effective strategies for fighting 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 change socio-economic disadvantage experienced by Aboriginal and Torres Strait Islander communities.

Strategies that consult, empower, are 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 quietly on the receiving end of dictated policy.

Glossary

Aerosols - a liquid or gas under pressure in a can for releasing as a spray or foam.

Asphyxiation - a seriously low supply of oxygen to the body caused by abnormal breathing.

Cardiac arrhythmias - a condition in which the heartbeat is irregular, too fast or too slow.

Cognitive ability - the mental process of knowing, including aspects such as awareness, perception, reasoning, and judgment.

Chroming - the process of getting high from aerosol cans sprayed into a plastic or paper bag and inhaled.

Comorbidity - the presence of one or more additional disorders (or diseases) co-occurring with a primary disease or disorder; or the effect of such additional disorders or diseases. The additional disorder may also be a behavioral or mental disorder.

Consciousness - the state or quality of awareness of yourself, your surroundings and your thoughts.

Convulsion - a sudden, violent, irregular movement of the body, caused by involuntary contraction of muscles and associated especially with brain disorders such as epilepsy and/or, the presence of certain toxins or other agents in the blood.

Hallucination - an experience involving the apparent perception of something not present.

Hydrocarbon - a compound of hydrogen and carbon, such as any of those which are the chief components of petroleum and natural gas.

Inhalants - chemical vapors that are inhaled for their mind-altering effects.

Intoxication - drunkenness or excitement by way of a chemical substance.

Larynx - the hollow muscular organ forming an air passage to the lungs and holding the vocal cords in humans and other mammals; also called the voice box.

Lead encephalopathy - a degenerative disease of the brain caused by lead poisoning.

Neurological - the science of the nerves and the nervous system, especially of the diseases affecting them.

Pharmacological - to do with or related to the science dealing with the preparation, uses, and especially the effects of drugs.

Prevalence - a statistical concept referring to the number of cases of an occurrence that are present in a particular population at a given time

Psychological - related to the mental and emotional state of a person.

Psychosis - a severe mental disorder in which thought and emotions are so impaired that contact is lost with reality.

Psychotherapeutics - drugs used to treat psychosis. They affect mood and behaviour.

Spatial perception - the ability to sense the size, shape, movement, and orientation of objects.

Solvent - a substance that dissolves a solute (a chemically different liquid, solid or gas), resulting in a solution. A solvent is usually a liquid but can also be a solid or a gas.

Stigma - a mark of disgrace associated with a particular circumstance, quality, or person.

Tetraethyl lead - a compound containing the toxic metal lead that for much of the 20th century was the main agent which was added to make fuel burn more effectively.

Toxicological - related to the study of the nature, effects, and detection of poisons and the treatment of poisoning.

Vapour - visible particles of moisture floating in the air.

Volatile substances - substances such as petrol, and many household and industrial products.

Source adapted from: Google, Dictionary.com, Thesaurus.com

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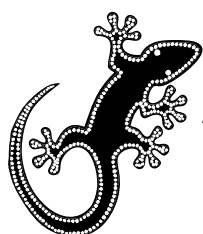
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Australian Indigenous HealthInfoNet

The Australian Indigenous HealthInfoNet's mission is to contribute to improvements in Aboriginal and Torres Strait Islander 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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