

LET'S CLEAR THE AIR

Air quality in NSW

The air we breathe is easy to take for granted. Yet air relates directly to our quality of life. While air quality has improved in the last 20 years, there is still plenty more we all can do in order to enjoy clean air now and in the future.

Air quality in NSW is generally good, especially compared to 15–20 years ago. This is mostly a result of cleaner cars and fuels, and tighter industry controls.

There are still a number of days each year where the pollution levels exceed national standards. This number is currently higher than the rate allowed for by the National Environment Protection Measure for Air.

The air pollutants that most often reach high levels are photochemical smog (ground-level ozone) and particles. Ground-level ozone occurs due to a reaction between VOCs (volatile organic compounds) and NOx (oxides of nitrogen) which are emitted all year round. Under warm, sunny conditions, these react together to form smog. You can see this as a white haze in summer.

High particle levels are generally due to dust storms or bush fires during summer. In winter, however, high levels of particle pollution are largely due to hazard reduction burns or woodsmoke. This can be seen as a brown haze.

NSW Health in partnership with the Department of Environment, Climate Change and Water NSW issues health alerts for forecast high pollution days.

Environmental impacts of air pollution can be less obvious but still significant. Larger particles emitted into the air are deposited across the local landscape. These can soil and damage materials, affect plant growth and health, and create a

grimy look around urban centres. They can also contaminate land and waterways.

Sources of air pollution can be natural, like bush fires and dust storms, or a result of human activity. Human activity includes burning fossil fuels in industry and transport (mostly particle and NOx emissions) using solvents in business and households (mostly VOC emissions) and using solid fuels for heating and cooking (mostly particle emissions).

Air pollution in the future is likely to increase unless we act now. Population growth and our increasing dependence on cars is a major factor.

With more people driving more cars more often, air pollution from transport is likely to offset gains made in other areas.

The other contributing factor is climate change.

Climate change and air pollution are closely related (see diagram overleaf).

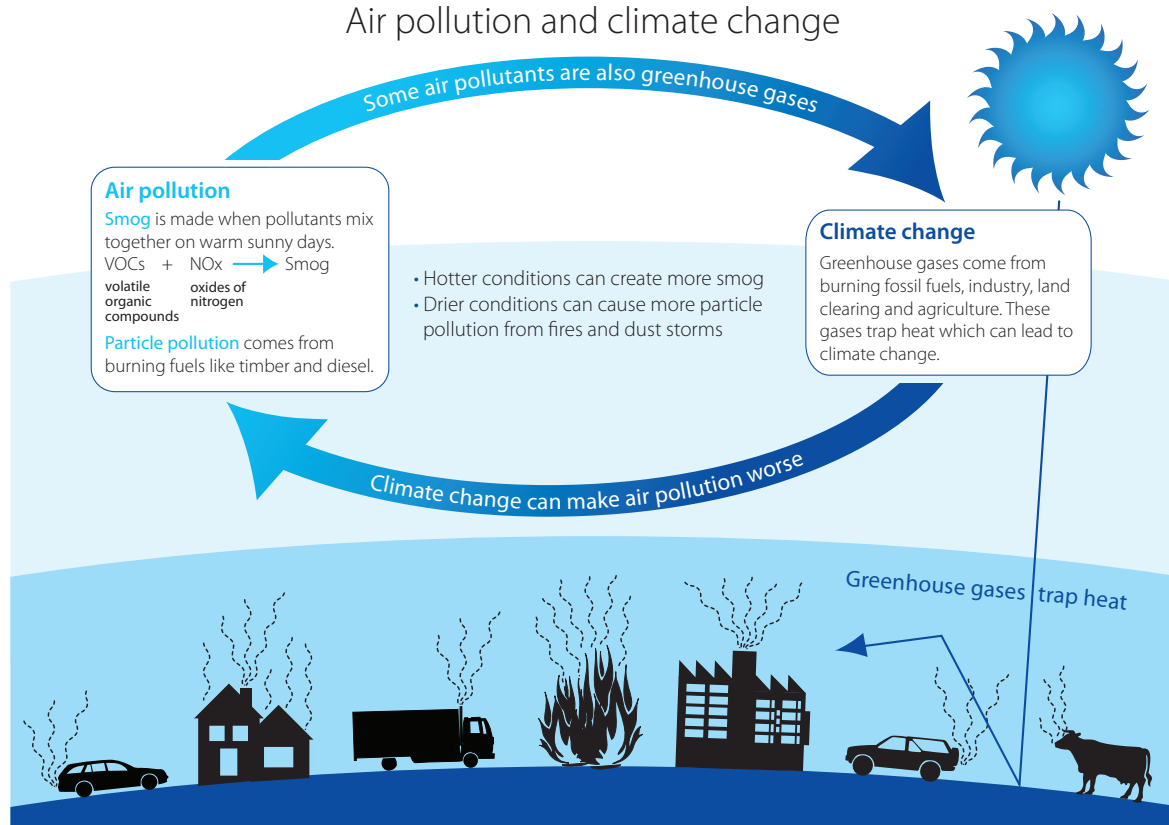
Warmer weather can provide ideal conditions for smog to form while drier conditions can increase the risk of bush fires and dust storms which create particle pollution.

Some pollutants are also greenhouse gases which lead to climate change. So as we take steps to reduce air pollution, we are also helping to address climate change.

Government actions like improving standards for cars and fuels, regulation for industry, emission reducing programs for businesses and public educational campaigns are making a difference.



Air pollution and climate change



Adapted from State of the Environment NSW 2000

Some day-to-day actions to take:

- **burn less fuel** and save money
- drive at a moderate and constant speed to use 20 per cent less fuel
- service your car regularly and maintain optimum tyre pressure
- plan your car trips – see if you can drive 1 kilometre less a day
- keep your boot empty – lugging extra weight uses more fuel
- turn off the air conditioning to use 10 per cent less fuel
- turn your engine off if idling for more than 30 seconds
- for short trips, try walking or cycling – there are 3,900 kilometres of cycleways in NSW
- for trip planning and other public transport information, visit 131500.com.au
- report smoky vehicles on the DECCW website – environment.nsw.gov.au
- **avoid products containing solvents** – cleaners, toiletries, furnishings, etc contain VOCs and can affect indoor air quality
- choose water-based products with pump sprays instead
- don't use solvents on hot days as they evaporate more quickly.

In winter

- **use your wood heater properly** – woodsmoke contains toxic chemicals which can pollute your home and our air
- only burn aged, dry wood
- allow plenty of oxygen into the fire
- don't let your fire smoulder overnight
- check that your heater meets Australian standards
- if possible, choose a more energy-efficient and less polluting way to heat your home eg. natural gas.

Check the air quality index (AQI)

(environment.nsw.gov.au/aqms/aqi.htm) for hourly updates on air quality across the state and to sign up for health alerts for both predicted high pollution days and notification if high pollution occurs on the day.

cleartheair.nsw.gov.au

has more tips on how to help clear the air.

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Air quality social research backgrounder

Where do NSW residents stand on air quality?

This collection of research findings is a summary extract from DECCW research from 1997–2007. Educators, media and communicators can develop a deeper understanding of attitudes and behaviours towards air quality in NSW. See published documents for more information.

Attitudes

- Air quality was found to be the **second most important environmental issue** for the people of NSW in the *Who cares about the environment?* surveys of 1997, 2000, 2003 and 2006. The proportion of people concerned was well below those concerned about water issues and **dropped in each survey** (from 32 per cent in 1997 to 20 per cent in 2006).
- In **2007, air quality issues ranked third** behind water supply/conservation and climate change, with 17 per cent of people nominating it as an issue.
- **Residents of Sydney** were much more likely to consider air pollution as one of the two most important environmental issues compared to all other areas in NSW (24 per cent in 2006, 19 per cent in 2007). In 2006, residents in inner urban Local Government Areas nominated this issue most (30 per cent). Outside Sydney, the region with people most likely to nominate air pollution as an issue was the south-eastern region (16 per cent). For all other regions, 6–14 per cent mentioned this issue.
- **People from non-English speaking backgrounds** were more likely to nominate air pollution/air quality as an important environmental issue (28 per cent compared to 19 per cent of those of English-speaking background in 2006), including motor vehicle emissions (14 per cent compared to 7 per cent). However, priority given to air issues has dropping for more than a decade. In 1996, air was the top issue (56 per cent) in specific ethnic communities research. This dropped to 30 per cent in 2004, then 28 per cent in *Who cares about the environment? 2006*.
- For those flagging air pollution or quality in both 2006 and 2007, this appears to have been based on **practical concerns** such as quality of life, eg. those living in a location with higher levels of air pollution. Findings from 2007 suggest that people are more likely to become engaged with air pollution as an issue of concern due to health or aesthetic concerns.
- People who mention air pollution as the most important issue are **less likely to mention climate change** as their second issue and vice versa, with air pollution as a more concrete and local issue, and climate change a broader and more abstract issue.

- Although some people simultaneously used the terms greenhouse gas emissions and air pollution together in relation to vehicles, the generic term 'emissions' was more commonly used, as was 'air pollution' as a separate term ie. it did not appear to be commonly known that vehicle emissions contain both air pollution and greenhouse gas emissions.
- In both 2006 and 2007, 5 per cent of people in the *Who cares about the environment?* surveys nominated air quality initiatives as the most important thing the state government could do to protect the environment. Air quality was the 4th most mentioned issue and the 6th rated initiative in 2006, dropping to the 5th issue and 8th rated initiative in 2007.

Perception of improvement or deterioration in air quality issues

- Since the *Who Cares about the environment?* research began in 1994, **perceptions of some air quality measures have been relatively stable**. About one quarter (22–29 per cent) have consistently seen improvements in general quality of the air over the previous three years, 33–40 per cent have seen deterioration, and 28–38 per cent seeing no change.
- There has been significant change in community perceptions since 2000 regarding **encouraging alternatives to motor vehicles** where **perception of improvement almost halved** (from 46 per cent in 2000 to 26 per cent in 2006) and perception of deterioration almost doubled (19 per cent to 36 per cent in 2006).
- **Sydney residents were more likely to think air quality had deteriorated** (41 per cent compared to 21–30 per cent in other areas) and that encouraging alternatives to motor vehicles had become worse (40 per cent compared to 26–33 per cent in other areas).
- **Younger people** (aged 15–24) were more likely to think there had been improvements in using alternatives to motor vehicles (43 per cent compared to 19–25 per cent).
- **Those with strongly pro-environmental views** were much more likely to view air quality as getting worse (52 per cent compared to 24–34 per cent in all other groups). They were also more likely to take active steps to reduce fuel consumption and vehicle air pollution.
- In DECCW focus groups, people talked about **air pollution as a visible problem**, seen to be worse in certain weather conditions ('still days'), and most noticeable for those whose dwellings or drive patterns have a distant view of the city. The main causes of air pollution were said to be transport, industry and bushfires/dust storms. Overall, air pollution was acknowledged but **not considered a pressing problem**.

Behaviours

- Those who reported often **reducing fuel consumption jumped by 10 per cent** from 38 per cent in the 2003 *Who cares about the environment?* survey to 48 per cent in 2006 but dropped back to 44 per cent in 2007, reflecting general changes in petrol prices at the times of the surveys.
- Only 28 per cent of respondents said they often tried to reduce their fuel use in both the 2006 and 2007 *Who Cares?* surveys.
- Compared to many other pro-environmental behaviours, a **high proportion** of respondents in *Who Cares?* surveys have **never tried to reduce fuel consumption**, though this is decreasing: 24 per cent in 2003, 18 per cent in 2006 and 17 per cent in 2007.
- **Saving money** was the most common reason given for reducing fuel consumption (51 per cent in 2006, dropping to 47 per cent in 2007).
- Focus group research revealed **people find it difficult to see how they could make a difference** to such a broad/widespread problem. Behaviours that reduce air pollution are generally undertaken for other reasons eg. bike riding for fitness and health, reducing car/fuel use for cost-saving reasons, changing to a cleaner vehicle for health reasons.
- **13 per cent of households in NSW do not have a vehicle**. While this has declined since 1996 (from 16.8 per cent), it is the highest of all Australian states and territories.
- Of 12 factors to consider **in buying a car, environmental impact rates lowest** and is dropping (5 per cent in 2003, only 2.4 per cent in 2006) but factors that impact air quality (vehicle size and fuel costs) are second and third after purchase price.

- **19 per cent of people in NSW use public transport to get to work or study**, the highest proportion for any Australian state or territory. In particular, NSW has the highest use of trains (12 per cent). NSW also has the highest use of public transport for non-work trips (18 per cent). Reasons for using public transport are practical, ie. cost, convenience and time-related, not environmental concerns. Reasons for not taking public transport are predominantly lack of services or timing of services (total 51 per cent); 23 per cent prefer the comfort, convenience and privacy of their own vehicle.
- **6 per cent cycle or walk to work**, mainly because they work close enough to home. Distance is the major reason (73 per cent) given for not walking or cycling to work or study.

Sources

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Air glossary

A guide for use of terms in cleartheair.nsw.gov.au and in the Air Education Resource Kit

Air NEPM

National Environment Protection Measure for Ambient Air Quality.

air pollutant

Chemicals or substances in the atmosphere, including odours, resulting from man-made activities or natural processes that cause adverse effects to human health, property and the environment. They can be in the form of solid *particles*, liquid droplets, gases or a combination thereof and can be directly emitted or formed by secondary reaction in the atmosphere.

Air pollutants monitored by DECCW and used in the calculation of the AQI include *ozone*, *carbon monoxide*, *sulfur dioxide*, *nitrogen dioxide* and *air particles*.

air pollution

The presence of contaminants or *pollutant* substances (including odours) in the air in high enough concentrations to interfere with human health or welfare or produce other harmful environmental effects.

air quality index (AQI)

A value derived from air quality data readings, which allows for more meaningful comparison of *pollutants* affecting air quality. The index is derived using the following formula:

$$AQI_{\text{pollutant}} = \frac{\text{Pollutant data reading}}{\text{Standard}} \times 100$$

AQI

See *air quality index*

airshed

A volume of air confined to a geographic region and within which *pollutants* are contained.

An area in which air quality is subject to common influences from *emissions*, meteorology and topography.

air toxics

Gaseous, aerosol or particulate *pollutants* present in the atmosphere in trace amounts with characteristics such as toxicity and persistence making them a hazard to human health, plant and animal life.

A class of *pollutants* including dioxins and furans, polycyclic aromatic hydrocarbons (PAHs), heavy metals and aldehydes, as well as VOCs.

ambient air

The external air environment (does not include indoor air).

anthropogenic

Human-made or related to human activity.

benzene

A type of *VOC* known to cause cancer at very low levels of exposure.

biodiesel

A type of biofuel made from oilseed crops, recycled cooking oil or waste animal fat.

Available at some service stations in NSW.

biogenic

Of natural origin.

biomass

The total mass of living matter in a given area.

carbon

An element which is the basis of all organic compounds or substances.

Often used to broadly refer to all *greenhouse gases*.

carbon footprint

A measure of the *greenhouse gas emissions* that can be attributed to an activity, an individual, a household or a business.

carbon dioxide (CO₂)

A colourless, odourless, non-poisonous gas that is a normal part of the *ambient air*. Although it does not directly impair human health, it is a *greenhouse gas* that traps infrared radiation and contributes to *global warming*.

A naturally occurring gas that is also a by-product of burning *fossil fuels* and *biomass*, other industrial processes and land-use changes.

The principal *anthropogenic greenhouse gas* that affects the earth's temperature.

Trees breathe in CO₂ and breathe out O₂.

carbon monoxide (CO)

An odourless, colourless, poisonous gas produced by incomplete oxidation (burning) of *carbon*-based fuels including petrol and diesel, oil and wood.

Natural sources: wildfires, oxidation in the oceans and air of methane produced from organic decomposition.

Human-made sources: the motor vehicle is by far the largest human source although any combustion process can produce it.

Enters the bloodstream through the lungs and prevents the normal transport of oxygen by blood to reduce the amount of oxygen reaching the body's organs and tissues, especially the heart.

People suffering from heart disease are most at risk; they may experience chest pain if they are exposed to carbon monoxide, particularly while exercising.

carbon neutral

Describes an activity which produces zero net *carbon emissions*.

carbon offset

Represent reductions in *greenhouse gases* relative to a business-as-usual baseline that are tradeable and often used to counteract all or part of another entity's *emissions*.

carcinogen

A cancer-causing substance.

climate change

A change of weather patterns that is attributed directly or indirectly to human activity which alters the composition of the global atmosphere and that is in addition to natural climate variability over comparable time periods (*UNFCCC*).

CSIRO

Commonwealth Scientific and Industrial Research Organisation (now known just as CSIRO).

DECCW

Department of Environment, Climate Change and Water NSW.

emissions

The release of *pollutants* into the atmosphere.

exceedence

An instance where the levels of a *pollutant* is above the *goal* or *standard*.

extreme pollution events

Infrequent events like bushfires and dust storms which generate extreme levels of *air pollution*. It is anticipated that the frequency of these will continue to rise as drought conditions continue due to *climate change*.

fossil fuels

A general term for buried combustible geologic deposits of organic materials, formed by decayed plants and animals that have been converted to crude oil, coal, natural gas or heavy oils by exposure to heat and pressure in the earth's crust over hundreds of millions of years.

Coal, oil or gas.

GHGs

See *greenhouse gases*

global warming

A rise in the Earth's overall temperature caused by an increase in heat-retaining gases in the atmosphere and responsible for changes in global climate patterns.

GMR

See *greater metropolitan region*.

goal

In relation to the achievement of the Air Quality Standards set by the *Air NEPM*, means the extent to which the *standards* are complied with (eg. maximum allowable *exceedences*).

See *standard*.

greater metropolitan region

Includes Sydney, the Central Coast, Lower Hunter and Illawarra regions.

Home to around 70 per cent of the NSW population.

greenhouse effect

The trapping of heat by heat-retaining atmospheric gases (including water vapour, *carbon dioxide*, *nitrous oxide*, methane and *ozone*) that keeps the earth about 30°C (60°F) warmer than if these gases did not exist.

greenhouse gases (GHGs)

Any gas that absorbs infrared radiation in the atmosphere.

Gases that cause *global warming* and *climate change*.

The major *GHGs* are *carbon dioxide* (CO₂), methane (CH₄), *nitrous oxide* (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulfur hexafluoride (SF₆).

ground-level ozone

A colourless, gaseous *secondary pollutant* which can form at ground-level when *VOCs* react with *NOx* in warm, sunny conditions.

Ozone is one of the key chemicals in *photochemical smog* and is often used as a measure of it.

Breathing *ozone* can affect lung function and worsen asthma.

health alerts

Issued at 4 pm in NSW if the *AQI* is likely to be above 100 the next day, a level at which people sensitive to the effects of *air pollution* are likely to feel its impacts.

Kyoto Protocol

An international treaty negotiated under the auspices of the *UNFCCC* entered into force in 2005.

Sets, among other things, binding targets for the reduction of *greenhouse gas emissions* by individual developed countries to be met within the first commitment period of 2008–12.

lead

A naturally occurring metal. Exposure can affect intellectual development in children.

Prohibition of the sale of leaded petrol since 2002 has eliminated the major source of lead in *ambient air*.

load-based fees

Licence fees that are based on the amount of particular *pollutants* that are discharged by industrial activity.

micrometres (µm)

A unit of length equal to one thousandth of a millimetre or one millionth of a metre.

nitric oxide (NO)

Is a colourless gas predominantly formed through combustion of *fossil fuels* (90 per cent nitric oxide and 10 per cent *nitrogen dioxide*) and is a *precursor* to *nitrogen dioxide* and is also an active compound in *photochemical smog* (*ground-level ozone*) formation.

Measured at certain monitoring sites, but not used in reporting the *air quality index* (*AQI*).

nitrogen dioxide (NO₂)

Is a reddish brown gas produced as a result of fuel combustion of *fossil fuels*, emitted directly and also as a result of the oxidation of *nitric oxide* in the atmosphere.

A respiratory irritant which can make existing respiratory illness symptoms worse.

Makes people with asthma more susceptible to lung infections and asthma triggers like pollen and exercise.

Nitrogen dioxide levels can be high near busy roads and also indoors when *unflued* gas appliances are used.

NO_x

Is the generic term for a group of oxidised nitrogen (N) compounds, expressed as the sum of NO and NO₂. Both man-made and natural (*biogenic*) processes emit NO_x.

In the atmosphere, *oxides of nitrogen* can contribute to the formation of *photochemical smog* (ground-level *ozone*), can impair visibility and have health consequences.

Oxides of nitrogen; includes *nitrogen oxide* (NO) and *nitrogen dioxide* (NO₂); an *ozone precursor*.

oxides of nitrogen

See *NO_x*.

ozone (O₃)

Is found in the *upper atmosphere* to protect the earth against the sun's damaging UV rays.

It is also a colourless, gaseous *secondary pollutant* formed by chemical reactions between *VOCs* and *NO_x* in warm, sunny conditions.

One of the key chemicals in *photochemical smog* and is often used as a measure of it.

Breathing ozone can affect lung function and worsen asthma.

ozone layer

Absorbs most of the harmful ultraviolet B (UV-B) radiation from the sun, which can cause skin cancer, cataracts, suppression of the immune system, etc and damage to agricultural crops, livestock, and industrial and domestic materials.

particles

Includes both solid particles and liquid droplets in a wide range of sizes that are suspended in the air and adversely impact health. Many *anthropogenic* and natural sources emit particles directly or emit other *pollutants* that react in the atmosphere to form particles.

The size of a particle determines its potential impact on human health. Particles 10 *micrometres* in diameter and less pose a health concern because they can be inhaled and accumulate in the respiratory system. Particles 2.5 *micrometers* in diameter and less ('fine' particles) are believed to pose the largest health risks as they can lodge deeply into the lungs.

particulates

See *particles*.

photochemical

Relating to the chemical reaction of light, including sunlight, see *smog*.

PM

Particulate matter.

PM₁₀

Particles with an equivalent aerodynamic diameter of 10 *micrometres* (µm) or less.

PM_{2.5}

Particles with an equivalent aerodynamic diameter of 2.5 *micrometres* (µm) or less.

pollutant

A contaminating substance or chemical, resulting from man-made activities or from natural processes that causes adverse effects to human health, property and the environment.

precursor

A chemical that is required for another compound to form, as in the course of a chemical reaction eg. *VOCs* and *NO_x* are *ozone* precursors, where they need to first be present to then react with each other in the presence of strong sunlight to form *ozone*.

primary pollutant

Emitted directly from a source.

radon

An inert gas produced when elements in soil and rocks decay.

Its decay produces alpha *particles* which damage lung tissue when inhaled.

Classified as a class 1 *carcinogen*.

RTA

Roads and Traffic Authority NSW.

secondary pollutant

Formed by the reactions of other *pollutants*.

smog

A complex mixture of *pollutants*, principally *ground-level ozone*, produced by chemical reactions in air involving smog-forming chemicals mainly *VOCs* and *NOx*.

Major *photochemical* smog occurrences are often linked to heavy traffic, sunshine, high temperatures and calm winds or temperature inversion. Smog is often worse away from the source of smog-forming chemicals (*precursors*), since the chemical reactions forming smog occur in the atmosphere while the *precursors* are being blown away from their sources by winds.

A complex mixture of chemicals – mainly *ozone* and *nitrogen dioxide* – which appears as a white haze in urban areas during warm, sunny conditions.

SO₂

See *sulfur dioxide*.

solvent

In this context means any liquid containing a *volatile organic compound* (or combinations) which is used as a diluents, thinner, dissolver, viscosity reducer, cleaning agent or for similar uses. These organic liquids are principally derived from petroleum.

A substance used to dissolve another substance, for example bleach and methylated spirits.

standard

In relation to the *Air NEPM* means the maximum concentration of *pollutant* allowable for the averaging period specified based on health effects.

The standards for *ozone*, *carbon monoxide*, *sulfur dioxide*, *nitrogen dioxide* and air *particles* were set in 1998 by the National Environment Protection Council.

stratosphere

The lower major layer of the Earth's atmosphere, between 10 and 50 kilometres above the earth's surface.

Contains the *ozone* layer.

sulfur dioxide (SO₂)

Is emitted into the atmosphere through natural processes such as volcanic eruptions and *anthropogenic* activities such as the smelting of mineral ores containing sulfur and the combustion of *fossil fuels*.

The main human-made sources are the smelting of mineral ores containing sulfur and the combustion of *fossil fuels*.

A respiratory irritant which can worsen existing respiratory illness.

toxic

In relation to air *pollutants* means those *pollutants* that are known or suspected to cause cancer or other serious health effects, such as reproductive effects or birth defects, or adverse environmental effects.

Poisonous.

UNFCCC

United Nations Framework Convention on Climate Change.

unflued

Not externally vented.

VOCs

Organic compounds that evaporate readily at room temperature and normal pressure and include petrol, industrial chemicals such as *benzene*, *solvents* such as toluene and xylene, degreasers and paint thinners. *VOCs* contribute to *ground-level ozone* production and some are also *air toxics* (eg. *benzene*).

Volatile and semi-volatile *organic compounds* (mainly hydrocarbons).

An ozone precursor.

volatile organic compounds

See *VOCs*.