Department of Environment and Conservation

Fact sheet: Midland Background Air Quality Study August 2007 – November 2008

Study overview

A 15-month study of air pollutants in Midland and surrounding suburbs by the Department of Environment and Conservation (DEC) took place from August 2007 to November 2008. This screening level study was undertaken as part of an ongoing and broader investigation of air quality throughout Perth and regional Western Australia since 2004. DEC air quality scientists undertook the investigation with assistance from local community members. The results of this study were reviewed by the WA Department of Health (DoH) to assess possible adverse health impacts to the community in and around Midland. DoH has advised that the concentrations measured in this study are similar in magnitude to those previously reported for Perth and are unlikely to be associated with adverse health effects. A final review of the study data was undertaken by DEC, Department of Health and CSIRO Marine and Atmospheric Research.

Why was the study conducted?

The study was conducted:

- in response to community concern about brickwork emissions
- to characterise background air quality in an area with diverse air pollution sources including brickworks; rendering, asphalt and concrete plants; abattoirs/sale yards; and light and heavy vehicles using the Great Eastern and Great Northern highways. See Figure 1 for the locations of major emission sources.

The Midland study aimed to:

- monitor and assess background air quality in Midland and its surrounding suburbs
- gather data on levels of selected air pollutants at a number of locations in Midland and surrounding areas to help with future health risk assessments and other studies
- compare the measured levels of air pollutants against established air quality guidelines
- engage and encourage participation from all stakeholders, including the community, special interest groups, other State and Federal agencies and industry
- provide information to assist in the review of brickwork licences.

Midland is one of a number of locations in Western Australia where DEC has monitored air quality. Others include: Kwinana, Bunbury, Busselton, Geraldton, Albany, Wagerup, Collie, Kalgoorlie, Port Hedland and Esperance.

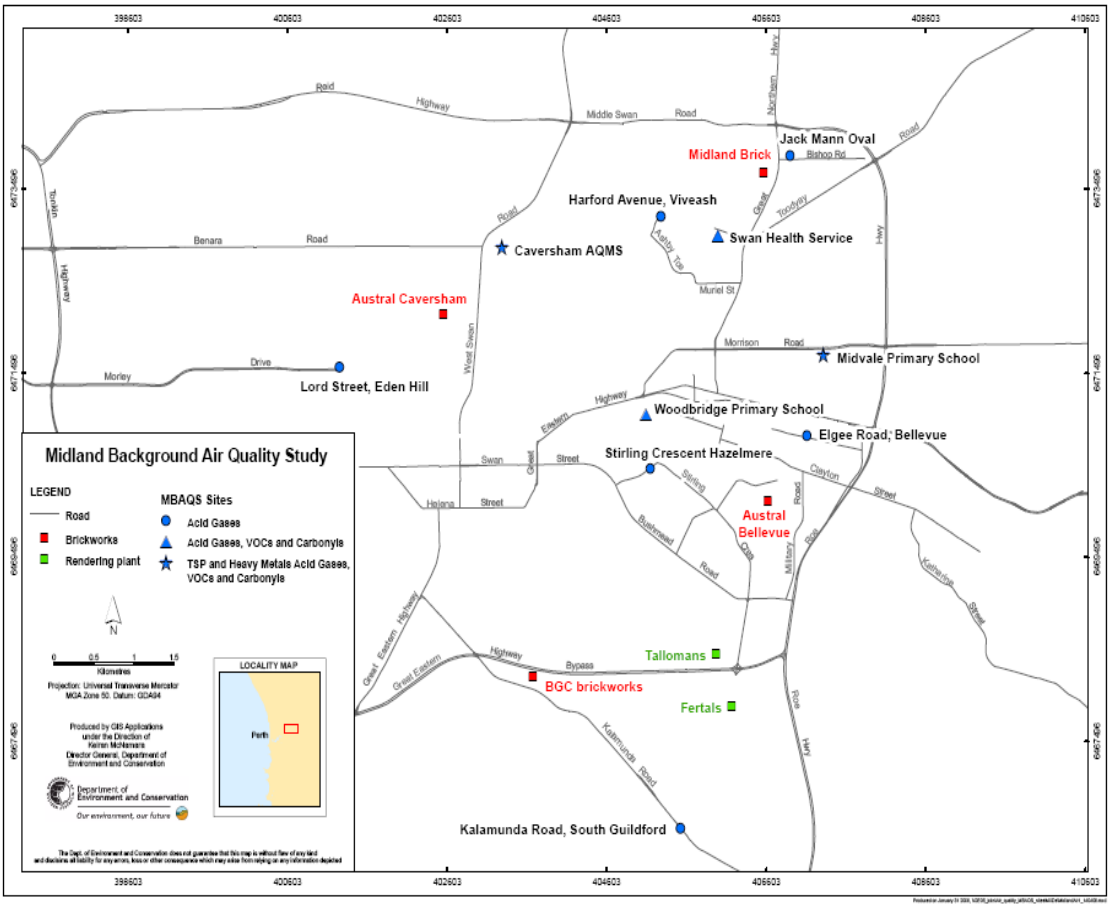

Figure 1: Sampling sites and pollutants measured at each site in the study and locations of major emission sources.

How was the study design chosen?

A pilot trial conducted in the Midland area in December 2006 found that a combination of air sampling methods would be appropriate to characterise background air quality in Midland and its surrounding suburbs. Community input was sought on the most appropriate locations for monitoring instruments and which pollutants should be measured during the study. DEC designed the sampling regime and project specifications after consulting with members of the community who registered their interest in the study in 2007.

Community interest in the study was sought in two ways, through a mailout to more than 18,000 homes in the Midland area, and at a community open day at the Midland Town Hall in February 2007.

What was monitored?

The air pollutants monitored were decided in consultation with stakeholders and local residents. These included:

- acid gases - hydrogen fluoride, hydrogen chloride, sulfur dioxide and nitrogen dioxide
- total suspended particulates
- heavy metals - including lead, chromium, cadmium, mercury, vanadium, manganese, nickel, arsenic and aluminium
- volatile organic compounds - including benzene, toluene, ethylbenzene and xylene
- carbonyls - including formaldehyde, acetone and acetaldehyde.

These pollutants were measured and compared with relevant guidelines, including those established in the National Environmental Protection (Ambient Air Quality) Measure.

How was the monitoring conducted and who was involved?

A combination of monitoring methods was used including 'active' electronic analysers and 'passive' samplers at 10 sites. DEC staff managed the monitoring equipment at all sites.

At many sites, passive samplers were used. These do not require power to operate and can therefore be used in a wider range of locations. They provide a screening level of monitoring, confirming which substances are present and provide an estimation of air pollutant concentration over a seven-day averaging period.

The passive and active samplers are shown below:

Figure 2: Passive samplers

Figure 3: A high volume sampler used to monitor particulates and heavy metals

The community was involved in the study through a canister sampling program. As part of this program, 12 six-litre stainless steel sampling canisters were provided to members of the community in Helena Valley, High Wycombe, Viveash, Middle Swan, Midland, Woodbridge and Bassendean to collect air samples at times when an odour was detected.

These suburbs were considered to provide a representative spread of locations for community sampling activity in the Midland area. Participants in the community sampling program were provided with training and support and were given log books to record sample details, including the date and time of sample collection, the reason for taking the sample and any noted health effects. The first canister sample was taken on 24 October 2007, and the last sample was taken on 3 October 2008. A sampling canister is shown in Figure 4.

Figure 4: A stainless steel sampling canister used in the community sampling program

In addition to the community sampling program, 12 community members from Hazelmere, Helena Valley, High Wycombe, Swan View, Middle Swan, Woodbridge and Caversham were provided with log books to document any odour events during the study, including location, intensity, signs of visible air pollution, weather conditions and any health effects.

Where were the monitoring locations and why were they chosen?

The sampling locations for the study included four fixed monitoring sites located at the Caversham Air Quality Monitoring Station, Swan Health Service Campus, Midvale Primary School and Woodbridge Primary School. An additional six locations in Bellevue, Viveash, Eden Hill, Hazelmere, Middle Swan and South Guildford were included to monitor the presence of hydrogen fluoride, hydrogen chloride, sulfur dioxide and nitrogen dioxide.

The 10 locations (see Figure 1) were chosen based on scientific modeling, community complaints data, proximity to sensitive receptors such as schools, potential emission sources, population density and availability of power and security.

What were the key findings of the study?

Acid gases

Hydrogen chloride was detected in approximately 60 per cent of the samples. There were significant differences in annual averaged hydrogen chloride concentrations between monitoring sites. Some elevated concentrations of hydrogen chloride were detected in six samples taken at Midvale Primary School. The concentrations of these six samples ranged from 19 µg/m^3 to 99 µg/m^3. While some elevated HCl concentrations were accompanied by high field blank samples and/or low duplicate samples which may be used to cast doubt over the accuracy of the concentrations, DEC has determined that these concentrations nevertheless require further investigation. (see “Where to from here”? section at the end) Advice received from the DoH indicates that these concentrations are not likely to be associated with any health effects. The DoH provided a guideline value of 100 µg/m^3 over 24 hours for total acid gases after reviewing international health guideline values. It is not appropriate to directly compare the 24-hour

guideline with a seven-day sample, so DEC has investigated and trialed alternative monitoring techniques to measure acid gases over shorter averaging times.

Hydrogen fluoride was only detected in seven samples from Jack Mann Oval, which represents approximately one per cent of all hydrogen fluoride air samples collected at all the sites during the study. The concentrations of these seven samples ranged from 1.4 µg/m^3 to 2.5 µg/m^3. Advice received from the DoH indicates that these concentrations are not likely to be associated with any health effects.

The results of monitoring sulfur dioxide and nitrogen dioxide showed that their ambient concentrations within the study area were well below the National Environment Protection Measure (NEPM) annual average standards at all monitoring sites. The NEPM annual average standard for sulfur dioxide is 0.02 ppm (20 ppb) and the NEPM annual average standard for nitrogen dioxide in 0.03 ppm (30 ppb). Although relatively low, the highest annual average value for sulfur dioxide (1.16 ppb) in the study was at Jack Mann Oval, and the highest annual average value for nitrogen dioxide (1.99 ppb) was at Caversham Air Quality Monitoring Station.

Total suspended particulates

Dust or total suspended particulates (TSP) was monitored over 24-hour periods by high volume sampling instruments and showed concentrations of 28.6 µg/m^3 at the Caversham Air Quality Monitoring Station and 29.6 µg/m^3 at Midvale Primary School. These concentrations are similar to the annual average from Duncraig but much lower than historical annual average data from Queens Buildings (68.8 µg/m^3) located in the Perth CBD.

Heavy metals

The dust collected during the TSP sampling was analysed for 32 chemical elements (mostly heavy metals); only 19 of these were above the limit of detection and of those only seven had an annual average greater than the limit of reporting[1] of (0.05 ug/m^3.The annual average concentrations of aluminium and potassium exceeded the annual averages previously measured at Duncraig, Queens Buildings and Hope Valley; however aluminium is abundant in soils of the region and potassium is a widely used ingredient in fertiliser. Although the annual average concentrations of aluminium and potassium were higher than previously measured in Perth, DoH have advised that these concentrations are not likely to be associated with any health effects.

[1] The limit of reporting is the lowest concentration that can be reliably quantified and reported using a specific analytical method and instrument.
The limit of detection is the lowest concentration that a method or instrument can detect but not necessarily quantify.

Volatile organic compounds (VOCs) and carbonyls

Monitoring of a commonly encountered suite of volatile organic compounds comprising benzene, toluene, ethylbenzene, xylene, formaldehyde and acetaldehyde showed their concentrations were lower than their respective NEPM investigation levels. The measured concentrations were similar to the Perth Background Air Quality study of 2005–2006. Vehicle emissions from the nearby major transport routes (Great Eastern and Great Northern highways) are likely to be an important contributor to these VOCs.

Odour

The results of community observations recording perceived odour and health events during this study is summarised in Table 1. A total of 93 events were documented by the selected residents and during each event the possible source as well as the odour description and reported health effect were recorded. The participants most frequently attributed the source of odour in Midland to brickworks, which accounted for 90 per cent of odour events in Woodbridge, 28 per cent in Hazelmere and 25 per cent in Caversham.

The community odour reporting and community air sampling programs (using DEC supplied canisters) increased understanding of the relationship of meteorology and distribution of odour impacts. VOC concentrations determined from the community (canister) air sampling program were similar to those elsewhere within the Perth metropolitan area.

Table 1: Odour source type, description and health effects reported by residents who participated in the community odour sampling

Source type	Odour description	Health effect reported
Brickworks	Acrid smell, caustic stench, chemical odour, sugary smell, sulfur smell	Headache, nausea, sore/burning throat, burning sensation in the nose
Rendering plant	Blood and bone type smell	No effects reported
Asphalt/ bitumen plant	Bitumen smell, strong asphalt odour	No effects reported
Burnt tyres/ diesel	Burning diesel, burning tyres/rubber	Headache, runny nose, coughing
Stockyard/ abattoir	Smell of stockyards in the building, decaying body smell, intense smell in the morning, believed to be stockyard	Respiratory problems

Where to from here?

The original project specifications described how DEC would use passive samplers to carry out screening level monitoring, and investigate more advanced instruments that would enable the continuous monitoring of acid gases. Consistent with this plan, DEC has purchased a precision instrument for the continuous monitoring of acid gases. The instrument, a Fourier Transform Infrared Spectrometer (FTIR), was installed at the Midland Police Operations Support Facility in late 2009 for testing. Testing will ensure that the instrument performs adequately and meets expected specifications. Following a detailed analysis of the instrument's performance, it is intended the instrument will be

deployed at a number of locations across Perth, including Midvale Primary School. This will be the first time continuous ambient acid gas monitoring has been conducted in Australia.

Future review of conditions on licences issued by DEC under the *Environmental Protection Act 1986* to industry in the Midland region will take account of the findings of this study and any subsequent ambient air monitoring in the region.

More information

All documents produced in relation to the 15-month study, including the full technical report, can be found on DEC's website at: http://www.dec.wa.gov.au/.

The DEC Air Quality Management Branch welcomes community enquiries and feedback and can be contacted by email to airquality@dec.wa.gov.au or by phone on 9333 7421.