Oxenford Air Monitoring Project

Fact Sheet: Oxenford crystalline silica and dust deposition – interim results from May to August 2020

Key messages

- Oxenford community members have reported concerns about the potential environmental and health impacts of dust emissions in the local area.
- The Department of Environment and Science (DES) is actively investigating the air quality in Oxenford to identify potential environmental and health risks to the community.
- The results from dust deposition monitoring did not exceed dust nuisance trigger levels. The deposited dust samples were mostly comprised of soil or rock particles.
- The concentrations of crystalline silica for the period May to August 2020 were very low with most samples below the limit of reporting. Low concentrations of crystalline silica were measured during August 2020 as a result of a region wide dust storm.
- DES is continuing to monitor air quality in Oxenford so that it can respond to risks to the community.
- The community is encouraged to continue to report any concerns about pollution events to the department through the Pollution Hotline: 1300 130 372 (option 2) or by emailing pollutionhotline@des.qld.gov.au

Summary

- Average $PM_{2.5}$ concentration for the period May to August 2020 collected from weekly filters was 3.9 µg/m^3, which does not exceed the EPP Air annual average objective.
- Average $PM_{2.5}$ crystalline silica concentration for the period May to August 2020 collected from weekly filters (0.04 µg/m^3) was approximately 1.3 per cent of the EPA Victoria annual criterion of 3 µg/m^3.
- Dust deposition rates for monthly samples collected between May and August 2020 complied with DES Air Impacts Guideline dust nuisance trigger limit value of 120 mg/m^2/day.

About the project

The Department of Environment and Science (DES) is currently undertaking an air quality monitoring program to gain a better understanding of air quality in the Oxenford area. The project was initiated in April 2020 in response to community concern relating to health impacts from the potential release of particulates, including respirable crystalline silica (RCS), from nearby industry. The project involves three different kinds of monitoring:

1. indicative real time air quality monitoring (April to September 2020)
2. dust deposition (April 2020-April 2021)
3. monitoring of crystalline silica (April 2020-April 2021).

This fact sheet provides the results from the dust deposition monitoring and monitoring of crystalline silica.

What was monitored?

Particulate matter ($PM_{2.5}$) and crystalline silica filter-based monitoring

Weekly $PM_{2.5}$ sampling was conducted using a Partisol® Model 2025i sequential low-volume air sampler operated in accordance with the Australian/New Zealand Standard *AS/NZS 3580.9.10:2006 Method 9.10: Determination of suspended particulate matter—$PM_{2.5}$ low-volume sampler—Gravimetric method*. The sampler drew air through a $PM_{2.5}$ size-selective inlet (which removed particles larger than $PM_{2.5}$) and then through a pre-weighed 47 mm diameter PVC filter over a seven-day period in order to obtain an acceptable detection limit for comparison against the annual guideline. The sampler automatically inserted a new pre-weighed filter in the air stream every seven days.

After sample collection, the filter was re-weighed and the difference between the pre-sampling and post-sampling weights was the mass of $PM_{2.5}$ particles collected. From this, the $PM_{2.5}$ mass concentration was calculated by dividing the mass of collected $PM_{2.5}$ by the volume of air (corrected to standard temperature and pressure) drawn through the sampler. Weighing of the PVC filters before and after sampling was performed by the NATA-accredited Queensland Government Safety in Mines Testing and Research Station (Simtars) laboratory.

The amount of crystalline silica present in the $PM_{2.5}$ matter collected on the Partisol® sampler filter was determined by infrared spectroscopy using a method based on the NHMRC *Method for Measurement of Quartz in Respirable Airborne Dust by Infrared Spectroscopy and X-Ray Diffractometry*[1] and NIOSH *Method 7602 Silica, Crystalline by IR (KBr pellet)*. The analysis method was capable of measuring crystalline silica down to 5 micrograms in the collected $PM_{2.5}$ matter, equivalent to a minimum measurable crystalline silica concentration of approximately 0.03 $\mu g/m^3$. The crystalline silica analysis was performed by the NATA-accredited Simtars laboratory.

Dust deposition

Deposited dust levels were measured using dust deposition gauges (comprising a funnel and collection bottle), which catch dust settling on the internal surface area of a funnel over monthly periods. Following the collection of each sample, the dust is washed from the bottle and then filtered and weighed. Results from dust deposition sampling are expressed as the weight of dust collected per unit of surface area per day, averaged over a standardised 30-day sampling period (i.e. mg/m^2/day averaged over a 30-day period).

Deposited dust samples are further characterised as:

- insoluble solids (the fraction of total particles deposited which are not water-soluble),
- ash (the part of the insoluble dust fraction which remains after heating the sample to a temperature of 850 degrees Celsius for 30 minutes), and
- combustible matter (the part of the insoluble dust fraction which is lost on heating the sample to a temperature of 850 degrees Celsius for 30 minutes).

Insoluble solids is the particle fraction typically responsible for nuisance impacts. Deposited dust is collected and analysed in accordance with the Australian/New Zealand Standard AS/NZS 3580.10.1:2016 *Method 10.1: Determination of particulate matter—Deposited Matter—Gravimetric method*.

[1] National Health and Medical Research Council, Canberra, ACT, 1984.

What were the results?

Weekly PM2.5 sampling

Summary data to date for $PM_{2.5}$ concentrations measured at the Oxenford monitoring site to date are provided in Table 1. Compliance with the $PM_{2.5}$ EPP Air annual and 24-hour objectives for the weekly sampling periods was not possible due to the sampling interval. Currently, the running average $PM_{2.5}$ concentration for the monitoring period from May to August 2020 (3.9 µg/m^3) does not exceed the EPP (Air) annual objective for $PM_{2.5}$ and is less than half this criterion value (8.0 µg/m^3).

Table 1: Summary of average $PM_{2.5}$ concentrations and $PM_{2.5}$ crystalline silica concentrations for sampling periods measured at the Oxenford monitoring site from May to August 2020

Sampling period		Run time (days, hours)	$PM_{2.5}$ concentration (µg/m^3)	$PM_{2.5}$ crystalline silica concentration (µg/m^3)
Start	Finish			
1-May-20	8-May-20	7 days	3.5	<0.03
8-May-20	22-May-20	6 days, 9 hours	4.1	<0.03
23-May-20	30-May-20	7 days	4.1	<0.03
30-May-20	6-Jun-20	7 days	3.5	<0.03
6-Jun-20	13-Jun-20	7 days	3.6	<0.03
13-Jun-20	20-Jun-20	7 days	3.5	<0.03
20-Jun-20	27-Jun-20	7 days	3.5	<0.03
27-Jun-20	4-Jul-20	7 days	4.2	<0.03
4-Jul-20	11-Jul-20	7 days	4.4	<0.03
11-Jul-20	18-Jul-20	7 days	3.5	<0.03
18-Jul-20	25-Jul-20	7 days	*No data*[b]	*No data*[b]
25-Jul-20	1-Aug-20	7 days	2.2	<0.03
1-Aug-20	8-Aug-20	7 days	4.1	<0.03
8-Aug-20	15-Aug-20	7 days	5.1	<0.03
15-Aug-20	22-Aug-20	7 days	4.0	0.25
22-Aug-20	29-Aug-20	7 days	6.0	0.16
Average for monitoring period to date			**3.9**	**0.04**

The Limit of Reporting (LOR) is the minimum measured crystalline silica concentration that can be determined with the analysis technique used (approximately 0.03µg/m^3). Concentrations below this limit are preceded by a "<" sign in the table.
[a] In calculating the average $PM_{2.5}$ crystalline silica concentration, half the detection limit (0.03) was used for concentrations below the detection limit.
[b] No data available for this period due to an instrument fault that interrupted the exchange of filters.

$PM_{2.5}$ crystalline silica

Measured $PM_{2.5}$ crystalline silica concentrations were very low with most samples below the limit of reporting (Figure 1). The running average $PM_{2.5}$ crystalline silica concentration for the sampling period to date is also shown. In the absence of a Queensland or national ambient air quality guideline for crystalline silica, measured concentrations of crystalline silica are compared against

the annual assessment criterion of 3 µg/m^3 specified in EPA Victoria's *Protocol for Environmental Management: Mining and Extractive Industries* (PEMMEI) for evaluation of possible health risk. The EPA Victoria criterion (shown in Figure 1) is based on crystalline silica present in the $PM_{2.5}$ fraction. The EPA Victoria criterion for $PM_{2.5}$ crystalline silica has been set at a level that provides equivalent protection to respirable (PM_4) crystalline silica guidelines.

All individual $PM_{2.5}$ crystalline silica concentrations were well below the annual average $PM_{2.5}$ crystalline silica criterion (Figure 1), including the running average $PM_{2.5}$ crystalline silica concentration (0.04 µg/m^3) for the monitoring period to date (Table 1). Low concentrations of $PM_{2.5}$ crystalline silica were measured during the 15-22 August 2020 and 22-29 August 2020 weekly sampling periods. Strong gusty westerly winds resulted in dust from inland New South Wales and southern Queensland being transported into south east Queensland on 20 and 22 August, which caused elevated particle levels across south east Queensland. Region-wide dust events can contain a proportion of respirable crystalline silica due to the high sand content of the windblown dust. These region-wide dust events are likely to have contributed to the low $PM_{2.5}$ crystalline silica concentrations measured during this period.

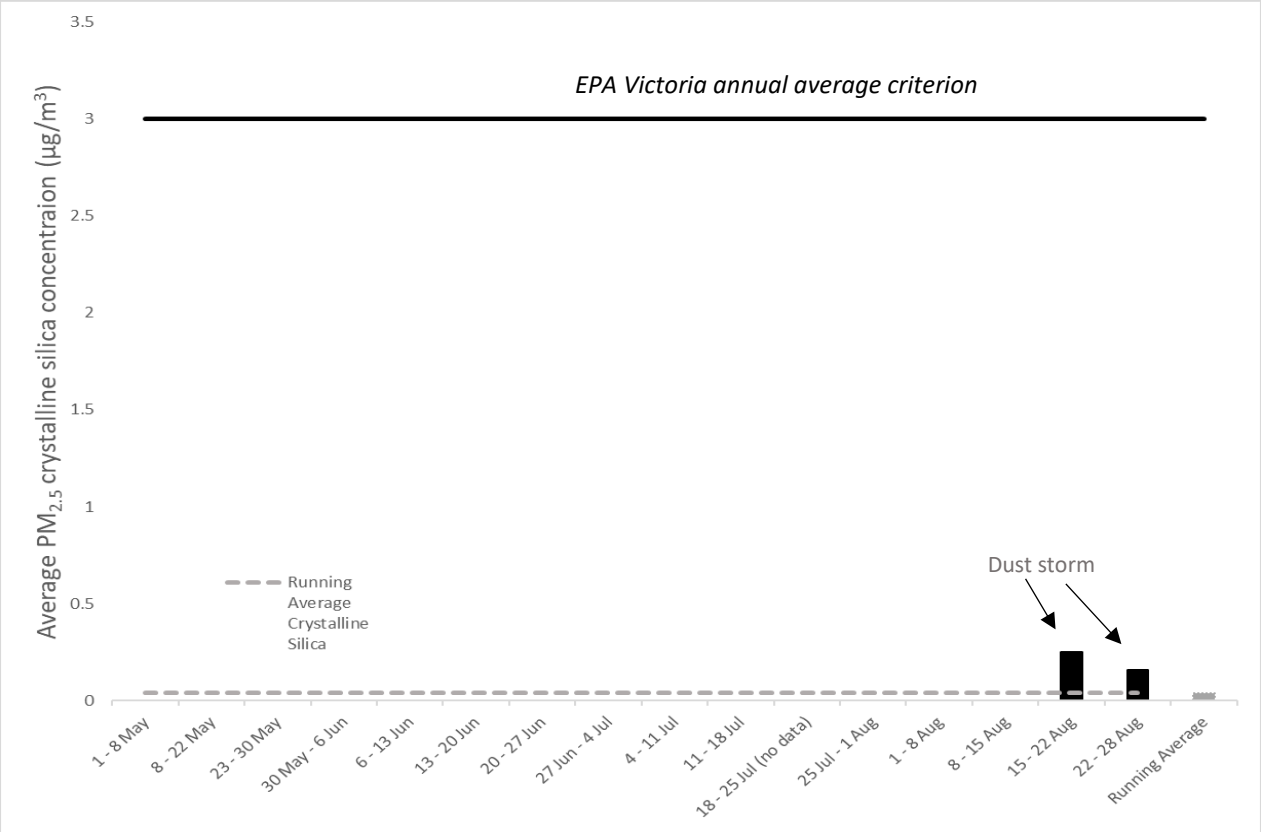

Figure 1. Average $PM_{2.5}$ crystalline silica concentrations for samples collected at the Oxenford monitoring site between May and August 2020

Dust Deposition

The Department of Environment and Science (DES) Air Impacts Guideline recommends an insoluble dust deposition limit of 120 mg/m^2/day, averaged over one month, be used to assess dust nuisance. Dust deposition results have not exceeded this guideline at the Oxenford monitoring site for the samples analysed to date and, further, are well below the guideline value (see Table 2 and

Figure 5 below). The insoluble deposited dust comprised mostly ash fraction, consistent with particles of a mineral nature.

Table 2. Average daily dust deposition rates (mg/m^2/day) at the Oxenford monitoring site, May to August 2020

Sampling period	Oxenford Dust Deposition Investigation		
	Dust deposition rate[a]	Ash	Combustible matter
	(mg/m^2/day)		
May 2020 30/04/2020 to 1/06/2020)	43	28	15
June 2020 (1/06/2020 to 1/07/2020)	22	15	7
July 2020 (1/07/2020 to 31/07/2020)	21	18	3
August 2020 (31/07/2020 to 31/08/2020)	39	22	16

The DES Air Impacts Guideline recommends that the insoluble solids deposition rate not exceed 120 mg/m^2/day (averaged over a normalised 30-day period) to minimise dust nuisance impacts.
[a] Sum of ash and combustible matter content may not equal insoluble dust deposition rate due to rounding

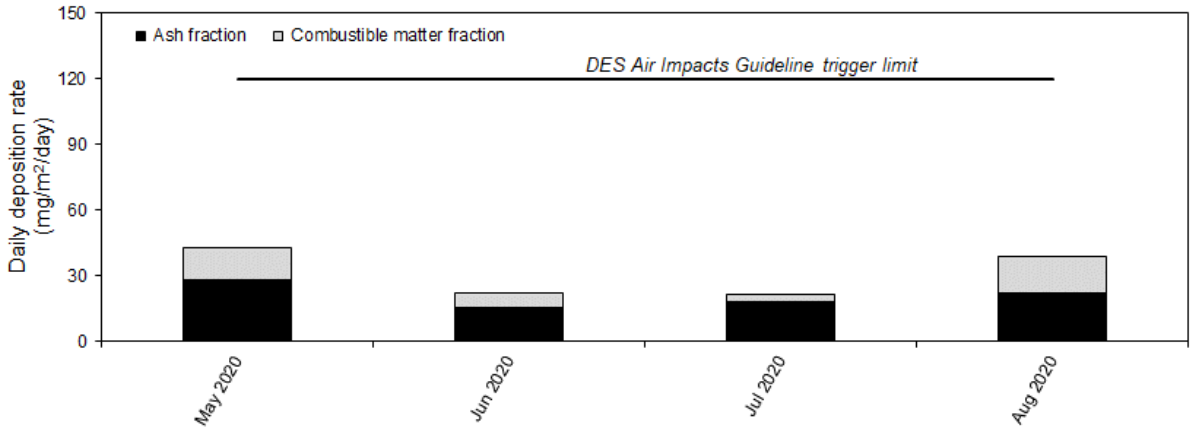

Figure 2. Average daily dust deposition rates (mg/m^2/day) at the Oxenford monitoring site, May to August 2020

Particle composition analysis of the deposited dust samples is conducted by the University of Queensland's Materials Performance Laboratory (UQMP) to assist with identifying likely sources of the dust. Sub-samples of the insoluble fraction of deposited dust samples are examined through a microscope and the proportions of different types of particles in each sub-sample are measured based on their surface area, with proportions below this level listed as dust particles (e.g. soil, rock, cement and glass), biological particles (e.g. insects and plants) and other general organic particles (e.g. wood, fibres and plastics).

Importantly, this microscopic examination is based on surface area coverage and not particle mass, therefore the proportions of different particle types (based on area) cannot be directly applied to particle deposition based on mass. Deposited dust samples collected from May to August 2020 were comprised mostly of soil and rock particles (88% or more of the sample surface area) (Table 3). There was also some plant and insect material present and small to trace amounts of black dusts such as coal, soot and black rubber dust.

Table 3: Deposited dust particle composition analysis results for Oxenford monitoring site, May to August 2020

Month	Surface coverage (%) of deposited dust sample[a,b]				
	Soil/rock	Other inorganic	Plant or insect	Black dusts	Other types
May	93	Trace	7	Trace	0
June	90	0	8	2	Trace
July	88	0	12	Trace	Trace
August	94	0	6	Trace	Trace

[a] the uncertainty in the measurement of surface coverage is typically ±5%.
[b] particle types that were artefacts of the sampling method and not present in the air environment (such as copper sludge from the added algaecide and photosynthetic slime and fungi from biological growth) have been excluded and the surface area coverage of the remaining particle types proportionally scaled up to give a total surface area coverage for atmospheric particles of 100 per cent.

Appendix A.

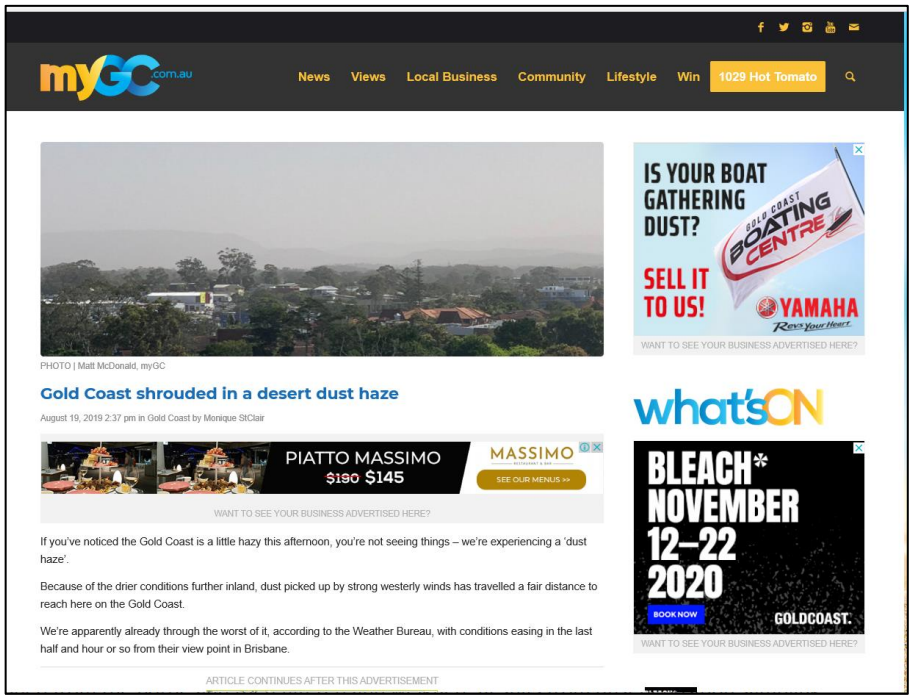

Figure A.1: Dust storm report on 20 August 2020 (Source: mygc.com.au, https://www.mygc.com.au/gold-coast-shrouded-in-a-desert-dust-haze/)

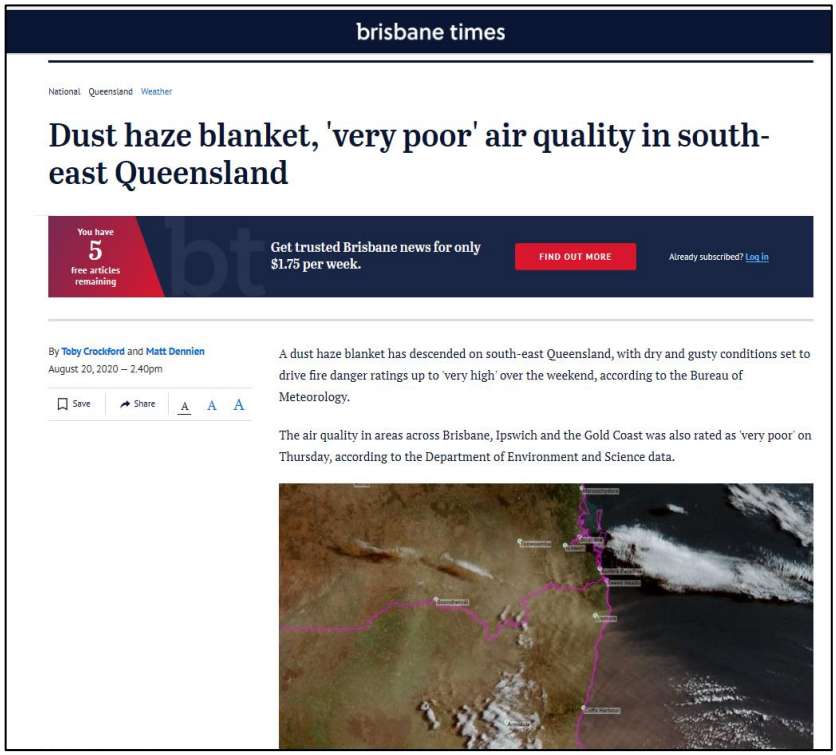

Figure A.2: Dust storm report on 20 August 2020 (Source: https://www.brisbanetimes.com.au/national/queensland/dust-haze-blanket-very-poor-air-quality-in-south-east-queensland-20200820-p55nme.html)

Figure A.3: Dust storm report on 20 August 2020 (Source: Bureau of Meteorology Twitter, https://twitter.com/BOM_Qld/status/1296211354832056322)

Figure A.4: Dust storm report on 22 August 2020 (Source: Bureau of Meteorology Twitter, https://twitter.com/BOM_Qld/status/1296982149237813250)