

SA Health risk assessment of airborne dust collected on 1 January 2017

SA Health received the quantitative results of the elemental metal analysis from two filters which contained airborne dust collected on the 1 January 2017 when dust exposure was extremely high following the breakdown of the dust suppressant. Unlike the previous sample, these samples were not restricted to wind directions from the ash dam, but took in dust from all wind directions. The results were expressed as micrograms per cubic metre ($\mu\text{g}/\text{m}^3$) which is relevant for comparison to health-based reference values. It expresses the average amount of dust in one cubic metre on the day of measurement.

Health-based reference values from the World Health Organization (WHO) and the Agency for Toxic Substances and Disease Registry (ATSDR) based on respiratory uptake were used to assess whether any health risk levels were exceeded for any specific metal-related substance, noting that there are few if any guidance values for the lanthanoid and actinoid series of elements. Data collected elsewhere suggest that many of these are in nanogram concentrations as back-ground in SA soils.

The two samples collected dust at Sterling North and Lea Memorial Oval. The airborne dust collected was size selected and represents total suspended particles (TSP) referring by definition to particles which are approximately smaller than 100 μm in diameter.

The high dust level on 1 January 2017 is reflected overall in the higher levels of metals measured in the two samples compared to the previous sample which was collected in October 2017. At Lea Memorial Oval, the 24 hour exposure was 438.7 $\mu\text{g}/\text{m}^3$, more than 7-fold compared to the daily average of 58.5 $\mu\text{g}/\text{m}^3$ (2005–17). For Sterling North, the TSP concentrations was 278.9 $\mu\text{g}/\text{m}^3$, which is 4.7 fold compared to the average of 59.3 $\mu\text{g}/\text{m}^3$ (2005–17).

The analysis results indicate that the concentrations of the metallic fractions in the samples were mostly at the nanogram and microgram level. The levels for many metals are consistent with normal background levels elsewhere. Other metal concentrations are consistent with levels found near coal/oil/industrial combustion sites worldwide.

Apart from the metal manganese (Mn), the concentrations of metals were well below any health-based guideline. For Mn, the concentration was 0.137 $\mu\text{g}/\text{m}^3$ at Sterling North and 0.150 $\mu\text{g}/\text{m}^3$ at Lea Memorial Oval, while in October 2017, the levels were only 0.003 $\mu\text{g}/\text{m}^3$. These levels compare to a WHO guideline of 0.150 $\mu\text{g}/\text{m}^3$ for Mn applied as an annual level.

Considering that the guideline is set for an annual average and the samples only reflect one in 365 days, it is apparent that Mn concentrations at both locations have not exceeded the guideline. It is also extremely unlikely that Mn concentrations would reach guideline levels if daily measurements were undertaken given the level of dust required to achieve the 0.150 $\mu\text{g}/\text{m}^3$ WHO level.

Of most concern is the high overall dust level which was measured on this day, with a high fraction of particles sized smaller than 10 μm in diameter (PM₁₀). PM₁₀ concentrations were available from the Sterling North monitoring station, where 53.3 $\mu\text{g}/\text{m}^3$ were measured. The PM₁₀ sized particles are considered to reach into the respiratory system, where they can elicit cardiopulmonary health effects. As there is a quasi-linear relationship between levels of dust and health outcomes, it is important to keep dust exposure to a minimum. This is relevant for short- and long-term exposure.