# Port Pirie Blood Lead Levels

Analysis of blood lead levels for 2019
(1 January – 31 December 2019)

Government of South Australia
SA Health

# Background

## Situated 230 km north of Adelaide in South Australia, Port Pirie is the location of one of the world's largest lead and zinc smelters.

The smelter has been in continuous operation since 1889. Over time, airborne lead-contaminated dust produced during smelter operations has contaminated the local environment. Even small amounts of lead can be toxic when ingested or inhaled. Lead-contaminated dust continues to be emitted by the smelter and these ongoing emissions, together with legacy lead from past operations, are a persistent source of exposure for the Port Pirie community.

SA Health has provided voluntary blood lead screening through the Port Pirie Lead Implementation Program that has been delivered by the Port Pirie Environmental Health Centre since 1984. This Program monitors and helps the local community reduce the amount of lead that children absorb by providing lead exposure-reduction advice, education and interventions for families. This paper reports the analysis of blood lead levels of Port Pirie children aged 0-4 years (0-1824 days of age i.e. up to the date of a child's fifth birthday) for each year since 2010.

# Australian Lead Guidelines

The National Health and Medical Research Council (NHMRC) provides health advice and health guidelines for the Australian community, governments and health professionals. One of the NHMRC's tasks is to advise the Australian community about lead exposure and the health effects of lead and how they can be managed.

## Guideline for investigating lead exposure

The NHMRC recommends that if a person has a blood lead level greater than 5 micrograms per decilitre (µg/dL), the source of lead exposure should be investigated and reduced, particularly if the person is a child or pregnant woman. See the Frequently Asked Questions: NHMRC Review of blood lead level guidelines.

The NHMRC advises it is well established that exposure to lead at blood lead levels above 10 µg/dL can have harmful effects on a number of body functions and organs in both adults and children. Research now shows that blood lead levels below 10 µg/dL may also be associated with some health effects (NHMRC 2015, Evidence on the effects of lead on human health). At this stage, the NHMRC has concluded that the evidence is not strong enough to show that lead is the cause of these effects.

In line with NHMRC's guidance, the blood lead levels of children living in Port Pirie are reported against the exposure investigation level of 5 µg/dL. This is in addition to the target level of 10 µg/dL that has been reported each year since 2000, and was the target level of the Targeted Lead Abatement Program when it commenced in 2014.

### Port Pirie results

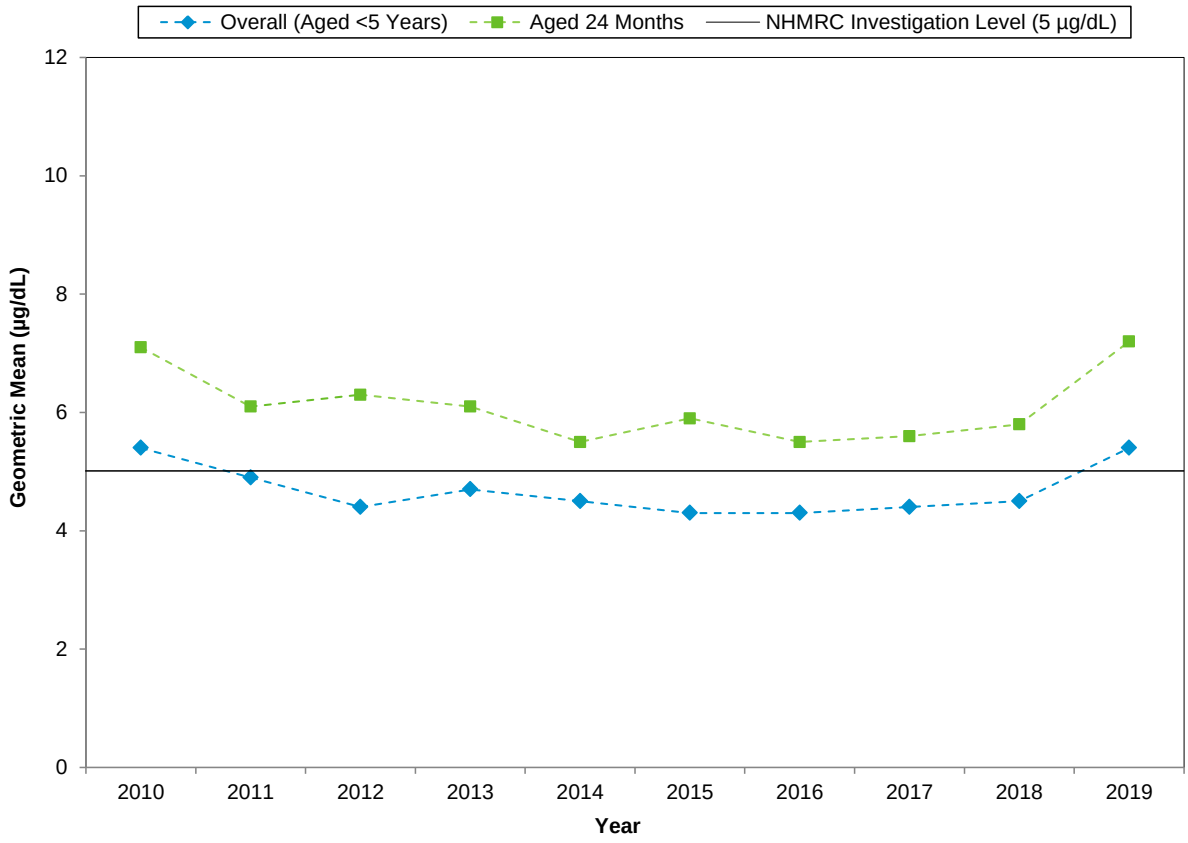
Blood tests indicate that the average blood lead level (geometric mean) of the children tested in 2019 was 5.4 µg/dL. This average has increased by 0.9 µg/dL compared to the same reporting period last year.

The average blood lead level (geometric mean) of children aged 24 months (tested at the time of their second birthday between 700 and 790 days after their birth) in 2019 was 7.2 µg/dL, which has increased by 1.4 µg/dL compared to the same reporting period last year. The geometric mean blood lead level for children aged 24 months is considered to be a robust indicator of trends in lead exposure for the whole population (Table 1).

Table 1: Geometric mean of children tested aged under five years (with surrogates) and aged 24 months (700-790 days) for each calendar year since 2010.

| Year | Total number of children tested | Geometric mean of children tested (µg/dL) | Number of children aged 24 months tested | Geometric mean of children aged 24 months tested (µg/dL) |
|---|---|---|---|---|
| 2010 | 704 | 5.4 | 121 | 7.1 |
| 2011 | 659 | 4.9 | 141 | 6.1 |
| 2012 | 641 | 4.4 | 107 | 6.3 |
| 2013 | 634 | 4.7 | 118 | 6.1 |
| 2014 | 628 | 4.5 | 135 | 5.5 |
| 2015 | 629 | 4.3 | 119 | 5.9 |
| 2016 | 645 | 4.3 | 113 | 5.5 |
| 2017 | 616 | 4.4 | 94 | 5.6 |
| 2018 | 599 | 4.5 | 93 | 5.8 |
| **2019** | **636** | **5.4** | **90** | **7.2** |

Figure 1: Geometric mean of children tested aged under five years (with surrogates) and aged 24 months (700-790 days) for each calendar year since 2010. This is a schematic illustration that represents the trend in geometric mean of children living in Port Pirie – it is not intended to infer that the data is continuous i.e. each data point does not represent the same group of children at each year.




Blood test results indicate that 43.2% of the children tested (together with surrogates) in 2019 had blood lead levels of 5 µg/dL or below (Table 2). This is a 6.7% decrease compared to the same reporting period last year.

These percentages cannot be reported or interpreted to represent the proportion of the Port Pirie population at 5 µg/dL or 10 µg/dL. This is because not every child living in Port Pirie was tested in 2019 and therefore their blood results do not appear in this analysis. If every child was tested, the proportion of the entire population with blood lead levels of 5 µg/dL or below falls somewhere between the lower limit of 42.2% and the upper limit of 44.3% (population estimates used to calculate these limits are based on Estimated Resident Population (ERP) data for Port Pirie updated by the ABS on 29 August 2019 using migration and birth rates in addition to 2016 census data).

In 2019, 361 children had a reported result greater than 5 µg/dL.

Table 2: Lead Exposure Investigation Level - Frequency of children tested with blood lead levels ≤5 µg/dL (with surrogates) for each calendar year since 2015.

| Year | Total number of children tested | ≤5 µg/dL | | | |
|---|---|---|---|---|---|
| | | n | Lower limit | % | Upper limit |
| 2015 | 629 | 365 | 56.6 | 58.0 | 59.4 |
| 2016 | 645 | 365 | 55.2 | 56.6 | 57.9 |
| 2017 | 616 | 328 | 51.9 | 53.2 | 54.6 |
| 2018 | 599 | 299 | 48.4 | 49.9 | 51.4 |
| **2019** | **636** | **275** | **42.2** | **43.2** | **44.3** |

## Targeted Lead Abatement Program

The Targeted Lead Abatement Program (TLAP) has been designed to identify and intensify community lead exposure reduction. In conjunction with the Port Pirie smelter redevelopment, TLAP will deliver the most significant reduction in lead emissions and community blood lead levels achieved in the life of the smelter. The TLAP blood lead level target was established to increase the number of children under five years of age below 10 µg/dL. This program now also focusses on driving levels below the NHMRC exposure investigation level of 5 µg/dL.

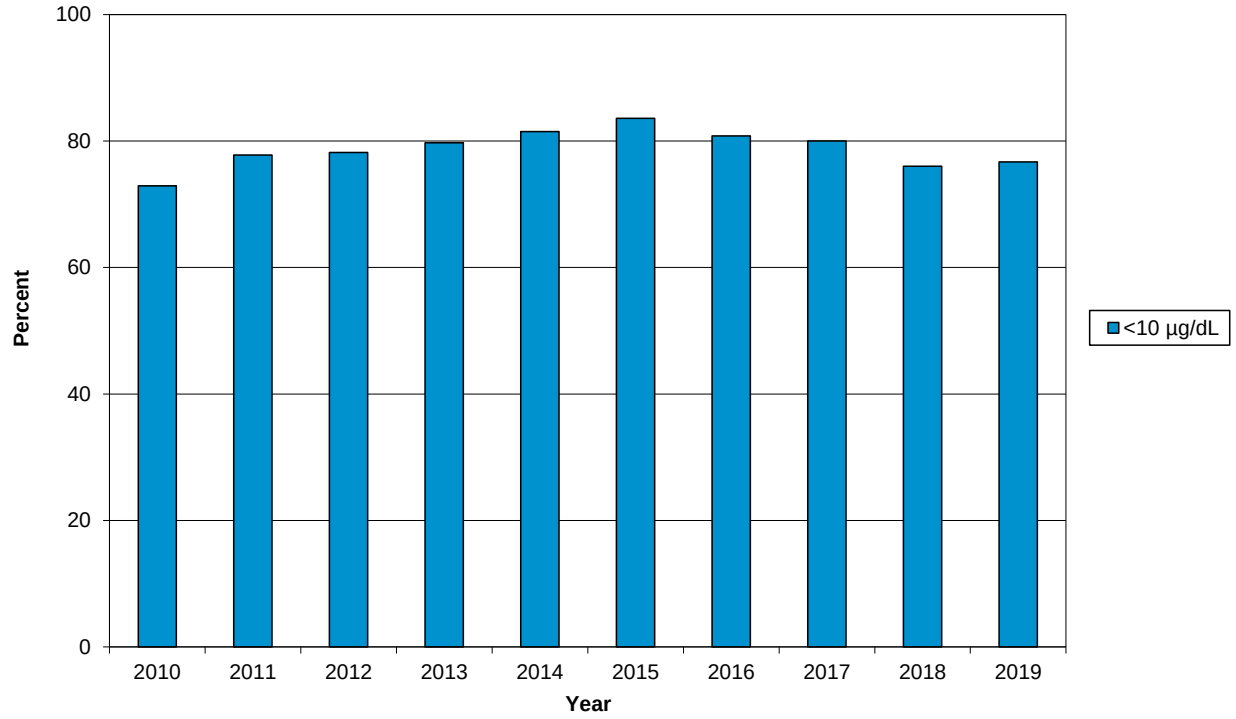
Blood tests indicate that 76.7% of children tested (together with surrogates) had blood lead levels below 10 µg/dL. This is a 0.7% increase compared to the same reporting period last year (Table 3).

The number of children with blood lead levels equal to or exceeding 20 µg/dL (13 children) has decreased compared to the same reporting period last year (16 children).

Table 3: Frequency of children tested with blood lead levels <10 µg/dL with surrogates for each calendar year since 2010.

| Year | Total number of children tested | <10 µg/dL | | | |
|---|---|---|---|---|---|
| | | n | Lower limit | % | Upper limit |
| 2010 | 704 | 513 | 71.6 | 72.9 | 74.1 |
| 2011 | 659 | 513 | 76.5 | 77.8 | 79.2 |
| 2012 | 641 | 501 | 76.8 | 78.2 | 79.5 |
| 2013 | 634 | 505 | 78.3 | 79.7 | 80.9 |
| 2014 | 628 | 512 | 80.3 | 81.5 | 82.7 |
| 2015 | 629 | 526 | 82.5 | 83.6 | 84.6 |
| 2016 | 645 | 521 | 79.7 | 80.8 | 81.8 |
| 2017 | 616 | 493 | 78.9 | 80.0 | 81.1 |
| 2018 | 599 | 455 | 74.6 | 76.0 | 77.2 |
| **2019** | **636** | **488** | **75.8** | **76.7** | **77.6** |

Figure 2: Percentage of children tested with blood lead levels <10 µg/dL with surrogates for each calendar year since 2010.



## Additional Annual Analysis

Blood tests indicate that the average blood lead level (geometric mean) of pregnant women tested in 2019 was 1.8 µg/dL (Table 4). This average has increased by 0.4 µg/dL compared to the same reporting period last year. This measure represents the blood lead level that a child has at birth.

Table 4: Geometric mean blood lead levels for all pregnant women tested (during pregnancy or immediately postpartum) for each calendar year since 2010.

| Year | Number of pregnant women tested | Geometric mean of pregnant women tested (µg/dL) |
|---|---|---|
| 2010 | 121 | 1.9 |
| 2011 | 161 | 1.7 |
| 2012 | 195 | 1.6 |
| 2013 | 175 | 1.5 |
| 2014 | 174 | 1.4 |
| 2015 | 196 | 1.5 |
| 2016 | 183 | 1.3 |
| 2017 | 143 | 1.4 |
| 2018 | 180 | 1.4 |
| **2019** | **158** | **1.8** |

Port Pirie has historically been divided into three lead exposure risk areas – low, medium and high. These correspond to the gradient of children's blood lead levels in these areas which in turn are determined by lead exposure. Factors contributing include; greater lead dust contamination levels, prevailing wind patterns, proximity to the smelter and ready penetration of contaminated dust into houses due to house age, construction type and style.

Children living in high lead exposure risk areas of Port Pirie have a blood lead level (geometric mean) which is 2.8 µg/dL higher than those living in low and medium lead exposure risk areas (Table 5).

Table 5: Geometric mean of children tested aged under five years (with surrogates) in high or low and medium lead exposure risk areas for each calendar year since 2010.

| Year | Total number of children in high lead exposure risk area | Geometric mean (µg/dL) | Total number of children in low and medium lead exposure risk areas | Geometric mean (µg/dL) |
|---|---|---|---|---|
| 2010 | 320 | 6.7 | 384 | 4.5 |
| 2011 | 319 | 6.5 | 340 | 3.7 |
| 2012 | 292 | 5.8 | 349 | 3.5 |
| 2013 | 299 | 6.0 | 335 | 3.9 |
| 2014 | 277 | 6.1 | 351 | 3.6 |
| 2015 | 283 | 5.5 | 346 | 3.5 |
| 2016 | 291 | 5.8 | 354 | 3.4 |
| 2017 | 263 | 5.7 | 353 | 3.6 |
| 2018 | 257 | 6.0 | 342 | 3.6 |
| **2019** | **266** | **7.2** | **370** | **4.4** |

## Analysis Methods

Children included in this report were less than five years of age (0-1824 days of age i.e. up to the date of a child's fifth birthday) and lived in Port Pirie at the time the blood test was taken (i.e. this is their age at the time the test was taken - not their current age). If more than one blood test was taken in the reporting period, the most recent test result was used in this analysis. This analysis can include a child's test result that may have been collected any time up to 364 days prior to the preparation of this report. For this reason, a child's most recent test result may not represent the child's current blood lead level. Results are reported with surrogates, where surrogate data (the mother's blood lead level) represents a child's blood lead level at birth. The mother's result is included until either their child's first test at age six months replaces it in the dataset or if the child has not had a test by age nine months, the mother's result is removed from the dataset.

Data in this analysis cannot be compared with data from historical reports because different analysis methods were used. For example, prior to 2005 a child's maximum test was used in the analysis whereas now a child's most recent test result is used. For this reason, trends are not comparable with published reports in the 2004 and 1984 program reviews. From 2007-2010, the number of children with blood lead levels above 10 µg/dL, using a five-year cohort of children was reported; again this trends indicator cannot be compared with the one-year cohort of children that is reported now.

All blood samples included in this report are analysed by Australian laboratories accredited for blood lead analysis by the National Association of Testing Authorities (NATA Australia). Blood testing service providers for the Port Pirie community blood lead screening program changed on 1 January 2019, allowing for more advanced analytical methods to be utilised.

A new blood-lead results database was commissioned in 2017 and operated concurrently with the existing database until 31 March 2018. Results of blood tests collected from 1 January 2018 have been extracted from the new database. Blood tests collected prior to 2018 will continue to be extracted from the old database.

True population proportions may vary between reports as they are adjusted from year to year for the estimated population size based on ABS census data. The population projection used to calculate this indicator is based on a linear extrapolation of the Estimated Resident Population (ERP) compiled by the ABS, updated quarterly between censuses and completely revised each time a population census is conducted. While the ABS states that the ERP is the most accurate estimate of the population, there is inherent inaccuracy involved in estimating population, with the largest margin of error recorded with small population sizes such as the population of children aged less than five years living in Port Pirie. Any minor change in determinants of population size such as migration and birth rate can cause a substantial change in population estimates as a result of the small population size.

These results cannot be interpreted to represent the entire population because test results for every child are not in every report. The reasons for this are:

- The blood lead screening program is voluntary and parents have the right to choose not to have their child tested.
- Not all children are tested by each report date. For example, for the first quarter report, approximately one quarter of the children enrolled in the screening program have been tested.
- Some children have a history of consistently low blood lead levels and have been assessed to remain at a low risk of lead exposure and developing lead-related health effects. These children will not benefit from ongoing testing beyond three years of age as part of their lead exposure management strategy. However, children at high risk of lead exposure are always encouraged to be regularly tested.
- Results pending re-test for confirmation are not included in this dataset but will appear in the next report.

***These reports are considered very reliable for reporting the proportion of the population with blood lead levels above 10 micrograms per decilitre (the children at highest risk). However, children with low blood lead levels are under-represented i.e. there is inherent bias in this analysis (for the reasons given above). There is no ethical way to correct this bias as testing cannot be mandated.***

Further information about the analysis methods used in this paper is available at Frequently Asked Questions Testing and Reporting Port Pirie Children's blood lead levels.

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