

## MODIFIED HIL-A CRITERIA FOR ARSENIC

Validation sampling reported a maximum concentration of arsenic in samples HSA02\_TS (350 mg/kg) and HSA03\_TS (170 mg/kg) which exceeded the default (Tier 1) HIL-A criteria for arsenic in the NEPM (100 mg/kg).

The location of these validation samples is shown in Figure 8, Appendix A, and tabulated data provided in Appendix C. The samples were collected from materials directly beneath a copper chromium arsenic (CCA) treated timber fence located on the eastern boundary of the Site.

The default HIL-A criteria assumes an exposure frequency of 365 days per year, and the time spent outdoors is four hours per day. The default criteria for arsenic in the NEPM is driven by exposure pathways involving soil ingestion by young children (0-5 years old).

The default exposure frequency is considered to be conservative noting:

- it is highly unlikely that a receptor would play outside 365 days per year
- it is highly unlikely that a child receptor would exclusively play in the location where the maximum concentration of arsenic was reported which is beneath a boundary fence in a limited area. The nature of outdoor activity for a child typically results in play within a number of different areas.

Using the HILs spreadsheet provided in the NEPM Toolbox<sup>1</sup> a modified HIL-A criteria for arsenic was developed. The exposure frequency was changed from 365 days per year to 292 days per year on the basis that there are on average 76.4 days with rain  $\geq 1$  mm in Brisbane based on data from the Australian Bureau of Meteorology (BoM) (refer to Attachment A). This change represents a reduction in the exposure frequency (days/per year) by 20% and is considered conservative noting other exposure parameters have not changed including:

- a child receptor from 0 to 5 years plays outdoors each day for four hours in the same location
- other factors which may also reduce exposure frequency such as illness and time away from the dwelling have not been accounted for.

Based on the change in exposure frequency to 292 days the modified HIL-A criteria for arsenic is 160 mg/kg.

A 95% upper confidence limit (UCL) and mean  $\pm$  standard deviation for samples representative of conditions along the eastern boundary of the site was calculated using ProUCL. These samples were collected beneath and/or in close proximity to the CCA timber treated fence located along the length of the eastern property boundary. These samples are considered to be representative of materials located along this boundary.

The input data is provided in Attachment B. The ProUCL output data is provided in Attachment C, and is summarised in the table below.

| Statistical parameter         | Arsenic value (mg/kg) |
|-------------------------------|-----------------------|
| UCL 95%                       | 143.5                 |
| Mean $\pm$ standard deviation | 51 $\pm$ 88           |

In summary the following is noted:

- the maximum value reported is 175% of the modified criteria and is therefore less than 250% of the criteria as required in Schedule B1 of the NEPM.

<sup>1</sup> <https://www.nepc.gov.au/nepms/assessment-site-contamination/toolbox>

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- the standard deviation (88 mg/kg) is less than 50% of the modified criteria as required in Schedule B1 of the NEPM.
  - the mean and UCL 95% are below the modified criteria for arsenic.

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## ATTACHMENT A – BOM DATA



Climate statistics for Australian locations

Monthly climate statistics

All years of record

Site information

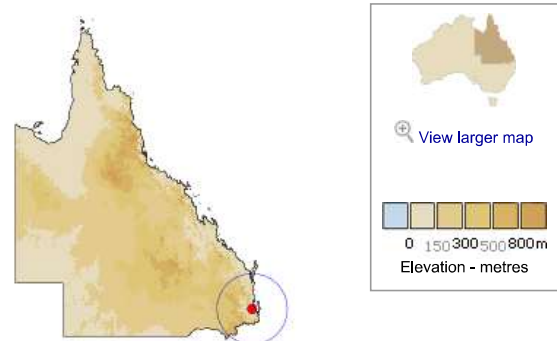
Site name: BRISBANE REGIONAL OFFICE  
Site number: 040214  
Latitude: 27.47 °S Longitude: 153.03 °E  
Elevation: 38 m  
Commenced: 1840 Status: Closed 01 Jul 1994  
Latest available data: 30 Jun 1994

Additional information

Additional site information

Nearest alternative sites

- 1. 040913 BRISBANE (2.0km)
- 2. 040236 NUDGEE (6.7km)
- 3. 040223 BRISBANE AERO (10.1km)



View: ☒ Main statistics ☐ All available

Period: Use all years of data

Text size: ☒ Normal ☐ Large

| Statistics                         | Jan   | Feb   | Mar   | Apr  | May  | Jun  | Jul  | Aug  | Sep  | Oct  | Nov  | Dec   | Annual | Years         |
|------------------------------------|-------|-------|-------|------|------|------|------|------|------|------|------|-------|--------|---------------|
| Temperature                        |       |       |       |      |      |      |      |      |      |      |      |       |        |               |
| Mean maximum temperature (°C)      | 29.4  | 29.0  | 28.0  | 26.1 | 23.2 | 20.9 | 20.4 | 21.8 | 24.1 | 26.1 | 27.8 | 29.1  | 25.5   | 99 1887 1986  |
| Mean minimum temperature (°C)      | 20.7  | 20.6  | 19.4  | 16.6 | 13.3 | 10.9 | 9.5  | 10.3 | 12.9 | 15.8 | 18.1 | 19.8  | 15.7   | 99 1887 1986  |
| Rainfall                           |       |       |       |      |      |      |      |      |      |      |      |       |        |               |
| Mean rainfall (mm)                 | 159.6 | 158.3 | 140.7 | 92.5 | 73.7 | 67.8 | 56.5 | 45.9 | 45.7 | 75.4 | 97.0 | 133.3 | 1149.1 | 145 1840 1994 |
| Decile 5 (median) rainfall (mm)    | 126.0 | 115.8 | 110.1 | 60.6 | 51.8 | 43.5 | 37.9 | 29.4 | 39.5 | 61.2 | 83.3 | 116.0 | 1106.7 | 138 1840 1994 |
| Mean number of days of rain ≥ 1 mm | 8.4   | 8.8   | 9.4   | 6.8  | 5.8  | 4.5  | 4.2  | 4.0  | 4.4  | 5.9  | 6.5  | 7.7   | 76.4   | 132 1841 1994 |
| Other daily elements               |       |       |       |      |      |      |      |      |      |      |      |       |        |               |
| Mean daily sunshine (hours)        | 7.4   | 6.6   | 6.5   | 7.2  | 6.9  | 6.8  | 7.4  | 7.9  | 8.2  | 8.0  | 8.4  | 8.1   | 7.4    | 26 1951 1983  |
| Mean number of clear days          | 4.0   | 3.5   | 6.7   | 8.7  | 10.7 | 12.1 | 15.2 | 15.4 | 14.1 | 9.2  | 7.4  | 6.1   | 113.1  | 35 1951 1986  |
| Mean number of cloudy days         | 14.3  | 13.4  | 12.8  | 8.7  | 10.0 | 8.1  | 7.4  | 5.9  | 5.9  | 9.9  | 10.7 | 12.1  | 119.2  | 35 1951 1986  |
| 9 am conditions                    |       |       |       |      |      |      |      |      |      |      |      |       |        |               |
| Mean 9am temperature (°C)          | 25.6  | 25.3  | 24.1  | 21.5 | 17.7 | 14.7 | 13.7 | 15.4 | 18.8 | 21.7 | 24.1 | 25.5  | 20.7   | 35 1951 1986  |
| Mean 9am relative humidity (%)     | 66    | 69    | 71    | 70   | 70   | 70   | 67   | 63   | 61   | 60   | 60   | 62    | 66     | 35 1951 1986  |
| Mean 9am wind speed (km/h)         | 7.8   | 7.5   | 7.3   | 6.8  | 7.3  | 8.4  | 8.1  | 7.6  | 7.0  | 7.1  | 7.1  | 7.1   | 7.4    | 35 1951 1986  |
| 3 pm conditions                    |       |       |       |      |      |      |      |      |      |      |      |       |        |               |
| Mean 3pm temperature (°C)          | 27.4  | 27.4  | 26.7  | 25.1 | 22.2 | 20.1 | 19.5 | 20.7 | 22.5 | 24.0 | 25.8 | 27.1  | 24.0   | 35 1951 1986  |
| Mean 3pm relative humidity (%)     | 59    | 60    | 59    | 55   | 52   | 51   | 46   | 44   | 46   | 52   | 55   | 57    | 53     | 35 1951 1986  |
| Mean 3pm wind speed (km/h)         | 14.4  | 13.6  | 13.1  | 11.0 | 9.5  | 9.9  | 10.5 | 11.7 | 13.3 | 14.3 | 14.5 | 14.9  | 12.6   | 35 1951 1986  |

red = highest value blue = lowest value

Product IDCJCM0027 Prepared at Thu 15 Feb 2024 04:16:00 AM AEDT

Monthly statistics are only included if there are more than 10 years of data. The number of years (provided in the 2nd last column of the table) may differ between elements if the observing program at the site changed. More detailed data for individual sites can be obtained by contacting the Bureau.

Related Links

- This page URL: [http://www.bom.gov.au/climate/averages/tables/cw\\_040214.shtml](http://www.bom.gov.au/climate/averages/tables/cw_040214.shtml)
- About climate averages: <http://www.bom.gov.au/climate/cdo/about/about-stats.shtml>
- Bureau of Meteorology website: <http://www.bom.gov.au>

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**ATTACHMENT B – PRO UCL INPUT DATA FOR EASTERN SITE BOUNDARY**

| Sample ID                    | Arsenic (mg/kg) |
|------------------------------|-----------------|
| HS12_ASH_230918              | 19              |
| HSA01_FILL_230920            | 10              |
| HSA01_TS_230920              | 74              |
| HSA02_FILL_230920            | 18              |
| HSA02_TS_230920              | 350             |
| HSA03_FILL_230920            | 43              |
| HSA03_TS_230920 (Rebatch As) | 170             |
| HSA04_FILL_230920            | 31              |
| HSA04_TS_230920              | 78              |
| A10                          | 11              |
| B10                          | 3.5             |
| C10                          | 6.8             |
| D10                          | 6.1             |
| E10                          | 8.9             |
| F10                          | 8.3             |
| G10                          | 7.4             |
| H10                          | 13              |

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## ATTACHMENT C – PRO UCL OUTPUT

| UCL Statistics for Uncensored Full Data Sets        |                                 |   |       |
|---|---------------------------------|---|-------|
|   |                                 |   |       |
| User Selected Options                               |                                 |   |       |
| Date/Time of Computation                            | ProUCL 5.116/02/2024 3:56:32 PM |   |       |
| From File   | Arsenic Input.xls               |   |       |
| Full Precision                                      | OFF                             |   |       |
| Confidence Coefficient                              | 95%                             |   |       |
| Number of Bootstrap Operations                      | 2000                            |   |       |
|   |                                 |   |       |
|   |                                 |   |       |
| Arsenic   |                                 |   |       |
|   |                                 |   |       |
| General Statistics                                  |                                 |   |       |
| Total Number of Observations                        | 17                              | Number of Distinct Observations                     | 17    |
|   |                                 | Number of Missing Observations                      | 0     |
| Minimum   | 3.5                             | Mean  | 50.47 |
| Maximum   | 350                             | Median  | 13    |
| SD  | 87.98                           | Std. Error of Mean                                  | 21.34 |
| Coefficient of Variation                            | 1.743                           | Skewness  | 2.898 |
|   |                                 |   |       |
| Normal GOF Test                                     |                                 |   |       |
| Shapiro Wilk Test Statistic                         | 0.57                            | Shapiro Wilk GOF Test                               |       |
| 5% Shapiro Wilk Critical Value                      | 0.892                           | Data Not Normal at 5% Significance Level            |       |
| Lilliefors Test Statistic                           | 0.299                           | Lilliefors GOF Test                                 |       |
| 5% Lilliefors Critical Value                        | 0.207                           | Data Not Normal at 5% Significance Level            |       |
| Data Not Normal at 5% Significance Level            |                                 |   |       |
|   |                                 |   |       |
| Assuming Normal Distribution                        |                                 |   |       |
| 95% Normal UCL                                      |                                 | 95% UCLs (Adjusted for Skewness)                    |       |
| 95% Student's-t UCL                                 | 87.72                           | 95% Adjusted-CLT UCL (Chen-1995)                    | 101.6 |
|   |                                 | 95% Modified-t UCL (Johnson-1978)                   | 90.22 |
|   |                                 |   |       |
| Gamma GOF Test                                      |                                 |   |       |
| A-D Test Statistic                                  | 1.249                           | Anderson-Darling Gamma GOF Test                     |       |
| 5% A-D Critical Value                               | 0.783                           | Data Not Gamma Distributed at 5% Significance Level |       |
| K-S Test Statistic                                  | 0.248                           | Kolmogorov-Smirnov Gamma GOF Test                   |       |
| 5% K-S Critical Value                               | 0.218                           | Data Not Gamma Distributed at 5% Significance Level |       |
| Data Not Gamma Distributed at 5% Significance Level |                                 |   |       |
|   |                                 |   |       |
| Gamma Statistics                                    |                                 |   |       |
| k hat (MLE)   | 0.67                            | k star (bias corrected MLE)                         | 0.591 |
| Theta hat (MLE)                                     | 75.34                           | Theta star (bias corrected MLE)                     | 85.42 |
| nu hat (MLE)  | 22.78                           | nu star (bias corrected)                            | 20.09 |
| MLE Mean (bias corrected)                           | 50.47                           | MLE Sd (bias corrected)                             | 65.66 |
|   |                                 | Approximate Chi Square Value (0.05)                 | 10.92 |
| Adjusted Level of Significance                      | 0.0346                          | Adjusted Chi Square Value                           | 10.21 |
|   |                                 |   |       |
| Assuming Gamma Distribution                         |                                 |   |       |
| 95% Approximate Gamma UCL (use when n>=50))         | 92.87                           | 95% Adjusted Gamma UCL (use when n<50)              | 99.28 |
|   |                                 |   |       |
| Lognormal GOF Test                                  |                                 |   |       |



|   |       |  |       |
|---|-------|--|-------|
| Shapiro Wilk Test Statistic   | 0.92  | Shapiro Wilk Lognormal GOF Test                |       |
| 5% Shapiro Wilk Critical Value  | 0.892 | Data appear Lognormal at 5% Significance Level |       |
| Lilliefors Test Statistic   | 0.169 | Lilliefors Lognormal GOF Test                  |       |
| 5% Lilliefors Critical Value  | 0.207 | Data appear Lognormal at 5% Significance Level |       |
| Data appear Lognormal at 5% Significance Level  |       |  |       |
| Lognormal Statistics  |       |  |       |
| Minimum of Logged Data  | 1.253 | Mean of logged Data                            | 3.014 |
| Maximum of Logged Data  | 5.858 | SD of logged Data                              | 1.279 |
| Assuming Lognormal Distribution   |       |  |       |
| 95% H-UCL   | 124.7 | 90% Chebyshev (MVUE) UCL                       | 88.04 |
| 95% Chebyshev (MVUE) UCL  | 108.6 | 97.5% Chebyshev (MVUE) UCL                     | 137.1 |
| 99% Chebyshev (MVUE) UCL  | 193.1 |  |       |
| Nonparametric Distribution Free UCL Statistics  |       |  |       |
| Data appear to follow a Discernible Distribution at 5% Significance Level   |       |  |       |
| Nonparametric Distribution Free UCLs  |       |  |       |
| 95% CLT UCL   | 85.57 | 95% Jackknife UCL                              | 87.72 |
| 95% Standard Bootstrap UCL  | 84.59 | 95% Bootstrap-t UCL                            | 168.1 |
| 95% Hall's Bootstrap UCL  | 224.4 | 95% Percentile Bootstrap UCL                   | 88.39 |
| 95% BCA Bootstrap UCL   | 106.1 |  |       |
| 90% Chebyshev(Mean, Sd) UCL   | 114.5 | 95% Chebyshev(Mean, Sd) UCL                    | 143.5 |
| 97.5% Chebyshev(Mean, Sd) UCL   | 183.7 | 99% Chebyshev(Mean, Sd) UCL                    | 262.8 |
| Suggested UCL to Use  |       |  |       |
| 95% Chebyshev (Mean, Sd) UCL  | 143.5 |  |       |
| Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.              |       |  |       |
| Recommendations are based upon data size, data distribution, and skewness.  |       |  |       |
| These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).                  |       |  |       |
| However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. |       |  |       |