Department of Health
Government of Western Australia

BAYSWATER DOMESTIC BORE WATER SAMPLING REPORT

Department of Health

September 2003

Overview

Groundwater contamination was discovered beneath the CSBP Cresco site in Bayswater in February 2003. A warning was issued in March 2003 by the Department of Health (DOH), Department of Environment (DOE) and City of Bayswater to users of bore water in the Bayswater area. In response to concerned residents living in the vicinity of the CSBP Cresco site, the DOH conducted a letter drop in the area on 4 April 2003 whereby residents living beyond the south, south-western or south-eastern boundary of the CSBP Cresco site were eligible to get their bore water tested and undergo a bore water exposure assessment.

The DOH received fifty phone calls from residents requesting their bore water be tested. In response to these requests, 40 properties were visited and 38 bore water samples were collected for chemical analysis.

Overall the results indicate that the water quality of all but one of the bores tested were in compliance with the *Australian Drinking Water Guidelines* (ADWG).

Parsons Brinckerhoff

Bore water sampling was also conducted by consultants Parsons Brinckerhoff Pty Ltd (PB) for CSBP. This occurred around late March to early April 2003 in the Bayswater area, south-west and south-southeast of the CSBP Cresco site, with an investigation report prepared in June 2003 (Parsons Brinckerhoff, 2003). A history of the CSBP Cresco site (prepared by Parsons Brinckerhoff) is summarised below for information.

History of the CSBP Cresco Site

The CSBP Cresco site was owned by an Australian fertiliser manufacturing company, *circa* 1928. The site was used to produce single superphosphate and sulphuric acid (Parsons Brinckerhoff, 2003). CSBP purchased Cresco's Western Australia operations in 1972 and manufacturing of sulphuric acid continued until production was transferred to Kwinana in 1975. The production of superphosphate was transferred to Kwinana in 1978 with the Bayswater site used for storage, packaging and distribution of superphosphate and other fertilisers thereafter.

Hydrochloric acid and small chemicals production was transferred from the nearby CSBP Bassendean facility to the Bayswater site in 1972 and the production of hydrochloric acid continued until 1990. This operation was eventually transferred to Kwinana in 1993.

In 1992 CSBP downsized the Bayswater site from an operational facility to a fertiliser depot. The soil and plant analysis laboratory and the CSBP Fertiliser Marketing Department were relocated in recent years, having been on the site since 1985 and 1997 respectively.

According to Parsons Brinckerhoff (2003), groundwater beneath the CSBP Cresco site in Bayswater is subject to contamination from on-site wastes produced historically from the manufacture of superphosphate, hydrochloric and sulphuric acids. The primary source of soil and groundwater contamination is "derived from an area located on the south-west corner of the site used for waste deposition or iron oxide and iron pyrite cinders" (Parsons Brinckerhoff, 2003).

Groundwater Impacts

A number of metals were detected in water samples, which represent contaminants from under the CSBP Cresco site. Metals commonly found to exceed the ADWG include:

- arsenic
- cadmium
- chromium
- lead

In addition, the results indicate that groundwater under the CSBP Cresco site contains elevated concentrations of iron, sulphate and fluoride levels, and is of a high acidity (pH 1.5-3.0). The high fluoride and acidity are particularly significant, as it is thought to provide a chemical signature of the groundwater migrating from the CSBP Cresco site (Parsons Brinckerhoff, 2003).

Results from Department of Health Sampling

In April 2003 the DOH distributed letters to Bayswater residents living on the south, south-western and south-eastern boundaries of the CSBP Cresco site, providing the opportunity for bore water testing and/or a groundwater exposure assessment. In response, fifty phone calls were received and forty properties were subsequently visited between April and May 2003. Bore water samples were collected from 38 of the 40 properties visited, with two properties not having accessible bores (one was a shallow well with no pump attached and another was a non-functional bore). Ten properties were not visited because they were either outside the affected area or did not want sampling. In addition, bores previously tested by PB were not retested by DOH except under the following circumstances:

- Bore water was below pH 5.5
- Bore water was used for drinking
- Residents had concerns about the water quality and wanted it tested.

Collection of the domestic bore water samples was conducted by officers of the Applied Environmental Health Branch and officers from DOE. In addition to bore water sampling, the DOH recorded pH readings at each bore and conducted a groundwater exposure survey, which gave an overview of the property and assessed the level of exposure to groundwater.

A summary of the main findings from DOH officers visiting the properties are as follows:

- 38 properties had their bore water tested.
- The main use of the bore water on the properties tested was for garden irrigation. However, the water from one bore was occasionally used for drinking.
- 23 properties specifically used bore water for garden/lawn irrigation
- 15 properties specifically used bore water to irrigate vegetable and fruit trees

- 2 properties used bore water to fill up fish ponds
- There was evidence of water discolouration and iron staining at some properties; however, the majority of water sampled was very clear.
- The pH levels of water sampled on the day of the inspection were mainly above pH 6. The average pH for all properties tested was 6.7.

A summary of the main findings of the bore water results sampled by the DOH are as follows:

The following list summarises the results of the DOH bore water sampling (also see Table 1 appended):

Aluminium Seven exceedances of the ADWG Aesthetic Guideline value of 0.2 mg/L. The highest exceedance was 6.1 mg/L.

Ammonia There is no ADWG Health Guideline Value for ammonia. There were no results above the ADWG Aesthetic Guideline Value of 0.5 mg/L. The highest value was 0.44 mg/L.

Arsenic All results were registered as <0.005 mg/L (limit of reporting (LOR).

Cadmium All results were registered as below the LOR; <0.0005 mg/L.

Cobalt All results were registered as below the LOR; <0.005 mg/L. There are no ADWG values for cobalt.

Chromium All results were registered as below the LOR; <0.002 mg/L.

Copper All results were below the ADWG Aesthetic Guideline Value of 1 mg/L and the ADWG Health Guideline of 2 mg/L.

Fluoride One detection of 4.4 mg/L exceeded the ADWG Health Guideline Value of 1.5 mg/L.

Iron Fifteen exceedances of the ADWG Aesthetic Guideline Value of 0.3 mg/L were recorded. The highest value was 46 mg/ with the remaining 14 properties ranging from 1.1-13 mg/L.

Mercury All results were registered as below the LOR; <0.0005 mg/L.

Magnesium Values for magnesium ranged from 5.7 mg/L to a maximum of 47.2 mg/L. There are no ADWG guideline values for magnesium.

Manganese Three sites were detected as having exceeded the ADWG Aesthetic Guideline Value of 0.1 mg/L, but they were less than the ADWG Health Guideline Value of 0.5 mg/L.

Molybdenum All values were registered as below the Health Guideline Value of 0.05 mg/L.

Nitrate All results for nitrate were below 11 mg/L, with the ADWG Health Guideline Value being 50 mg/L.

Nickel All detections of nickel were below the ADWG health guideline; 0.02 mg/L.

Lead All results were registered as below the ADWG health guideline; 0.01 mg/L.

Sulphate No property exceeded the ADWG Aesthetic Guideline Value of 250 mg/L. The highest concentration of sulphate was recorded at 210 mg/L, a level well below the ADWG Health Guideline Value of 500 mg/L.

Vanadium There were no results for vanadium above the LOR; 0.006 mg/L. There are no ADWG guidelines for vanadium.

Zinc There were no zinc detections greater than 0.36 mg/L with the ADWG Aesthetic Guidelines set at 3 mg/L.

pH The ADWG gives an aesthetic pH range for drinking water between 6.5 and 8.5. There were eight results outside the ADWG guidelines with seven of the properties having pH concentrations between 6.0 and 6.4. One property had a bore water pH of 3.6.

It was found that there were seven exceedances of the ADWG Aesthetic Guideline Value for aluminium (0.2 mg/L), with the highest exceedance being 6.1 mg/L. The guideline value for aluminium is based on the taste threshold rather than an adverse health effect. The bore water on these seven properties is not used for drinking water purposes and the levels of aluminium detected are not considered to pose a risk when the water is used for irrigation purposes only.

Fifteen properties were found to exceed the ADWG Aesthetic Guideline Value for iron (0.3 mg/L). The concentration of iron in the samples collected ranged from 0.062 - 46 mg/L. The guideline value for iron is based on the taste threshold rather than an adverse health effect. Sufficient information exists to indicate that iron in drinking water would not become a health concern unless the concentration was above 3 mg/L. This is well in excess of the concentration that would cause water to taste objectionable and it is unlikely that such water would be consumed. The elevated levels of iron seen would have caused water discolouration and iron staining on some properties.

The bore water on the properties affected by elevated aluminium and iron levels was not used for drinking water purposes and, therefore, the risk of bore water contact from these sources is considered low.

On the day of the survey, the average bore water pH measured on the properties was 6.7. The bore water results showed there were seven detections between pH 6.0 and 6.4

with one detection of pH 3.6 (Table 1). The ADWG gives an aesthetic pH range of drinking water between 6.5 and 8.5. The health implications of having bore water with very low pH include skin, nose, eyes and throat irritation upon contact with the water. Water used for irrigation may impair growth or loss of non-acid tolerant plants.

One detection of fluoride at 4.4 mg/L was found to exceed the ADWG Health Guideline Value of 1.5 mg/L. According to the ADWG (1996), regular consumption of water containing a concentration above 1.5 mg/L may disturb tooth mineralisation in children up to 6-8 years old, leading to mottling of the teeth. Regular consumption of water with fluoride concentrations greater than 4 mg/L increases the risk of skeletal fluorosis; a condition characterised by hyper-mineralisation, leading to brittle bones (ADWG, 1996). However, the bore water at this property was used for irrigation purposes only and such health effects would not be expected to occur.

Three sites were detected as having exceeded the ADWG Aesthetic Guideline Value for manganese (0.1 mg/L) but this was less than the ADWG Health Guideline Value of 0.5 mg/L.

All other parameters were within the ADWG Aesthetic and Health Guideline Values.

One property of particular concern had the bore situated adjacent to the Bayswater main drain. The results from this bore indicate that the profile of the bore water may be contaminated from water underlying the CSBP site. A pH of 3.6 indicates that the water is fairly acidic and high fluoride levels were also indicated (4.4 mg/L). The survey questionnaire results indicate that the groundwater from this source is not used for drinking. The survey also indicated that vegetation had been affected by the bore water, which is a likely result of the low pH. The DOH has recommended to the owner/occupant not to use the bore water for drinking or irrigation purposes. The DOH has been informed that CSBP have relocated the bore on this property with the owner's consent.

The profile of the bore water from the property of concern, in terms of the high fluoride and low pH, bears the same chemical signature as the contaminated groundwater migrating from the CSBP Cresco site.

Conclusions

- Overall there were no significant health issues with the bore water samples collected with the exception of one location. A letter explaining the result of the bore water analyses and exposure questionnaire was sent out to each of the 38 residents. The DOH advised that bore water was suitable for irrigation purposes for 37 properties.

- One property exceeded the ADWG Health Guidelines for pH and fluoride, which resembled the same chemical signature as the contaminated groundwater under the CSBP Cresco site. The householder of the premises was advised against irrigating or drinking from the bore by the DOH.

- Further investigation is needed to ascertain flow patterns of the contaminated groundwater plume under the CSBP Cresco site in order to facilitate the management of future water quality issues in the area.

- It is DOH policy that untreated bore water should not to be used for drinking water purposes because of possible microbiological and/or chemical contamination.

References

Parsons Brinckerhoff (June 2003) Final Report: An Investigation of the Water Quality of Domestic Bores in the Vicinity of the Former Cresco Site, Railway Parade, Bayswater.

NHMRC and ARMCANZ (1996). Australian Drinking Water Guidelines (ADWG). National Medical and Health Research Council and Agricultural and Resource Management Council of Australia and New Zealand, National Water Quality Management Strategy Vol. 6. Australian Government Publishing Service, Canberra.

Table 1. Comparison of bore water results with the *Australian Drinking Water Guidelines* (ADWG) (NHMRC, 1996)

	Health Guidelines (mg/L)	Aesthetic Guidelines (mg/L except pH)	Range of results in DOH samples (mg/L)
Aluminium	-	0.2	0.006-6.1*
Ammonia	-	0.5	0.02-0.44
Arsenic	0.007	-	<0.005
Cadmium	0.002	-	<0.0005
Chromium	0.05	-	<0.002
Cobalt	-		<0.005-0.013
Copper	2	1	<0.002-0.007
Fluoride	1.5	-	<0.1-4.4*
Iron	-	0.3	0.062-46*
Lead	0.01	-	<0.0005-0.0009
Magnesium	-	-	5.7-47.2
Manganese	0.5	0.1	<0.005-0.19
Mercury	0.001	-	<0.0005
Molybdenum	0.05	-	<0.002-0.01
Nickel	0.02	-	0.001-0.01
Nitrate	50	-	<0.01-11
Sulphate	500	250	40-210
Vanadium	-	-	<0.005-0.006
Zinc	-	3	0.011-0.36
pH	-	6.5 – 8.5	3.6*-7.4

Note that there are no Australian Drinking Water guidelines for Magnesium, Cobalt or Vanadium.

* Exceedance of the Australian Drinking Water Guidelines.