



Managing Soil Contamination in parts of Lutana and Hobart's eastern shore

Background paper, May 2009

Introduction

This paper provides supporting information for the Tasmanian Government Information Bulletin entitled "*Managing Soil Contamination in parts of Lutana and Hobart's eastern shore*"¹, and both documents have been developed to ensure information and advice to residents on this issue remains up-to-date. Included in this paper are an overview of the environmental and human health studies completed in the 1990's and in 2008, a summary of a review of the studies by the CSIRO, and an explanation of how that information forms the basis of the advice provided in the Information Bulletin.

Background

Past activities at the Hobart zinc smelter ('the zinc smelter'), which has been in operation since 1917, have resulted in the contamination of surface soils in parts of Lutana, Geilston Bay and Lindisfarne. The surface layer of soil in parts of these suburbs has been found to contain elevated levels of zinc, lead and cadmium.

The primary cause of this surface soil contamination was found to be dust blown from the zinc smelter. Dust from various open stockpiles at the zinc smelter was entrained by winds which predominantly blow up and down the Derwent Estuary. Following the identification of this issue in the 1980s, the zinc smelter removed these sources of dust by covering the exposed stockpiles or storing the materials in sheds.

Dust has been monitored both on and off the site since this time and reported to the Environment Protection Authority via requirements in the smelter's Environment Protection Notice and through the zinc smelter's Environmental Management Plan. Current ongoing dust monitoring in the community adjacent to the zinc smelter confirms that dust blowing from the site is no longer a significant source of soil contamination.

Overview of environmental studies

1990's studies

Concerns in relation to dust emissions from the smelter site were initially raised during the late 1980's. As a result, various soil and vegetable sampling programs were conducted by the company, the Tasmanian Government and the Glenorchy City Council. In 1992, a comprehensive, community-wide soil and vegetable sampling program was commissioned by the Tasmanian Government and conducted by the consultant John Miedecke and Partners Pty Ltd ('Miedecke').

Miedecke compiled the results of the various soil sampling programs in a summary report² ('the Miedecke report'), which was released in 1992. The Miedecke report also contained results from community-wide surveys of lead concentrations in blood and cadmium concentrations in urine conducted in 1991, and incorporated all of this data into a health risk model.

To gain a better understanding of the ways in which residents in the area could be exposed to the soil contamination, the consultancy Aquahealth was commissioned in 1993 by the Tasmanian Government to undertake further studies. This work determined levels of lead and cadmium in household dust and in worn areas of yards, recorded residents' behaviours in relation to home maintenance (such as the stripping of lead-based paint) and vegetable consumption, and examined the correlation between soil contaminant concentrations and rates of contaminant uptake by vegetables³.

Due to a decrease in the national acceptable lead in blood levels, a further study of children in the area was conducted in 1997 by the Menzies Centre⁴.

2008 Soil sampling

In early 2008, the Tasmanian Government and the current owner of the zinc smelter (Nyrstar Hobart) determined that a new soil sampling program would be beneficial in order to investigate if there has been a change in soil-metal concentrations. The new study also aimed to better define the extent of the impacted area by using modern, standardised collection techniques.

This new sampling program was conducted by the consultant Sinclair Knight Merz (SKM)⁵ in August 2008 and covered both the area previously sampled, as well as areas more distant from the smelter. This work was followed up by a review by CSIRO Land and Water of the previous sampling work and the 2008 program.

Results of previous work

1990's studies

Soil sampling conducted across Lutana and the eastern shore in the early to mid 1990's showed that the elevated levels of cadmium, lead and zinc were limited to the upper 50mm of the soil profile, with the majority concentrated in the upper 20mm. The sampling also showed that the dispersal pattern of the contamination had been influenced by the prevailing wind directions, the land topography and proximity to the smelter. Figures in the Meidecke report² show the sample locations and results from the various sampling programs.

The Aquahealth study and the results from the sampling of home-grown vegetables in the affected area showed that those vegetables which tend to accumulate cadmium (such as leafy greens) did tend to have levels of cadmium that were elevated above the food standard set by Food Safety Australia and New Zealand (FSANZ) for produce intended for sale⁶. (Note that there is no food standard set for home-grown produce). Cadmium results from root vegetables were largely within the food standard.

The Aquahealth study and vegetable sampling results also confirmed that lead does not tend to be taken up into plants as readily as cadmium, although surface dust could cause lead level results to exceed the food standard if the vegetables were not well washed before being eaten.

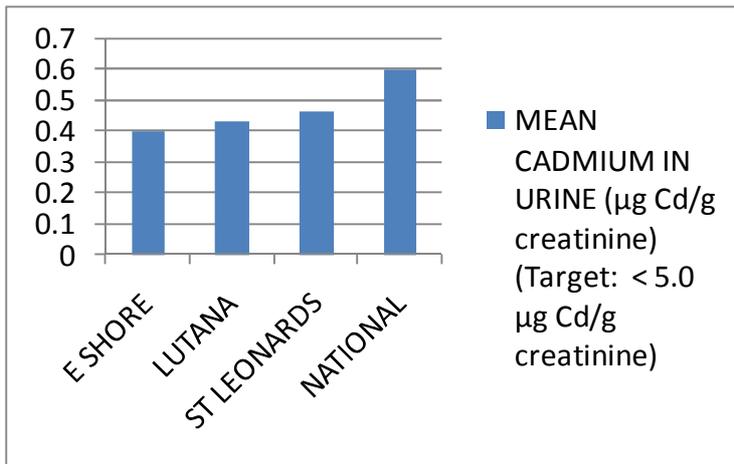
It should be noted that since the completion of the earlier studies, the food standard for lead in vegetables has lowered. As a consequence, some samples of carrots and leafy greens collected from home gardens in those studies would now exceed the food standard for produce intended for sale. Unlike for lead, the food standard for cadmium has been increased.

The health risk modelling presented in the Miedecke report in 1992 indicated that lead and cadmium were the metals of primary concern. The modelling results suggested that children living in the areas with the highest levels of contamination could be at risk of lead uptake through soil contact (e.g. by putting dirty hands or toys in their mouths after playing outside). The modelling also showed that adults living in the areas with the highest levels of contamination could be at risk of cadmium uptake where a significant portion of their diet was comprised of home-grown vegetables.

This modelling suggested that there were sectors of the community whose health was potentially at risk due to the contamination and indicated that further investigation into the issue was warranted. As such, direct health assessments (the direct measurement of the level of metals in the bodies of people living in the affected area) were conducted in 1991 and 1997.

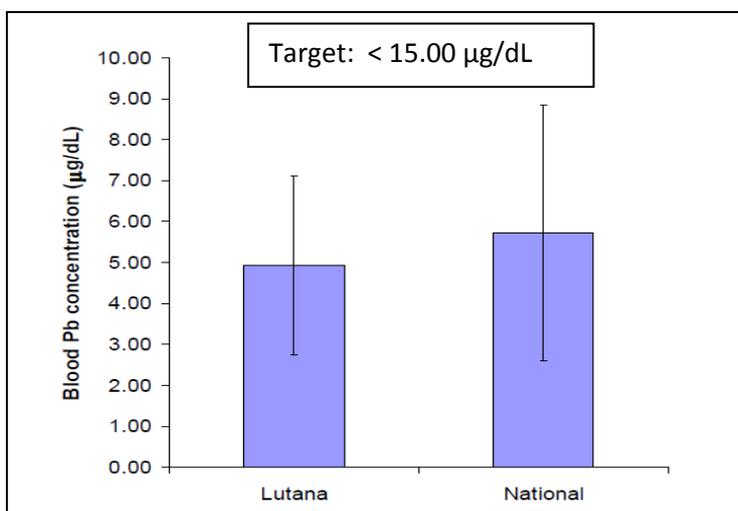
In 1991, measurements of urinary cadmium in 527 residents in Lutana and eastern shore suburbs indicated low population exposures with results that were comparable to a control group of 149 residents from the St Leonards suburb of Launceston (see graph below), and below the target level of 5.0 µg Cd/g creatinine.

MENZIES CENTRE URINARY CADMIUM SURVEY - 1991



Measurements of lead in the blood of children in the Lutana area in 1997 gave results that were similar to the national population, and below the then target level of 15 µg/dL (Note: this target level is currently under review). The graph below illustrates this; the solid bars represent the mean (average) results and the error bars (thin lines) represent the standard deviation in the data.

MENZIES CENTRE BLOOD LEAD SURVEY – 1997



The 1997 assessment⁷ was conducted concurrently with a national survey (the Australian National Blood Lead Survey) and focussed on the areas with the highest soil lead levels. Twenty-six children were tested, representing 78% of children under 5 years living in the area. A comparison with the results of the national survey indicated that children in the area had mean (average) blood lead levels slightly lower than the national averages (and below the then target level). Also consistent with national trends, the results were lower than the results of the 1992 survey; this being attributed to the banning of leaded petrol.

All the information available on the contamination issue was assessed and the Tasmanian Government released an Information Bulletin in 1999 recommending ways of reducing potential exposure to lead and cadmium in soil, dust and vegetables.

These direct health assessments found no evidence that the health of the residents was affected by the soil contamination and the findings did not support the need to repeat the health assessments in 2008. This conclusion was also assessed by CSIRO as discussed below under "CSIRO reviews".

2008 Soil sampling

The consultant SKM completed the most recent sampling program in August 2008. The results showed that, although the area of contamination has been defined in better detail, the overall distribution of soil contamination is consistent with previous soil sampling programs. The use of data modelling techniques has enabled the boundary of the "affected area" (discussed below) to be more accurately determined and this in part accounts for the amendment (and shrinking) of the area.

Overall, the concentrations of lead and cadmium found in the 2008 sampling program were not significantly different to previous surveys, although at selected sites, the surface soil had lower concentrations than previously detected. This may be due to soil disturbance, leaching or soil invertebrate activity.

CSIRO reviews

At the request of Nyrstar Hobart, CSIRO Land and Water reviewed the previous studies and provided comment on the ongoing relevance of the previous health risk assessments⁸. In a second report, CSIRO provided comment on the 2008 soil sampling survey⁹.

The sampling results from the 1990s and the 2008 sampling programs were judged to be precise and accurate. While the CSIRO provided comment in relation to certain aspects of the 1992 exposure modelling (notably that there have been changes in some exposure standards over the past 15 years), overall it concluded that the direct health measurements were the most relevant information and that there were no concerns in relation to the accuracy and ongoing relevance of these studies.

Delineating the affected area

The extensive sampling programs conducted have provided the basis for delineating the area considered to be affected by contamination from the zinc smelter. Both Information Bulletins (published in 1999 and 2009) have used the nationally-recognised soil Health Investigation Levels¹⁰ for a residential land use ('HILs A') to define this 'affected' area, as these are the levels that prompt further investigation if exceeded.

Advice for gardeners

The Information Bulletin¹ states that home grown vegetables, particularly leafy greens are best grown in raised beds with new clean soil to a minimum depth of 30cm. This is general precautionary advice and is not meant to indicate that adverse health effects will result from gardening directly in pre-existing soil; however, using uncontaminated soil from a reliable source will further reduce residents' exposure to the lead and cadmium. The advice is more relevant to

those who consume substantial amounts of home produced vegetables. The previous studies, as described earlier in this document, have shown that leafy greens (e.g. lettuce, silverbeet and spinach) grown in the hatched area marked on the map in the Information Bulletin will tend to exceed the food standard for cadmium for produce intended for sale ⁶. Lead does not tend to be taken up as readily as cadmium although surface deposition of soil containing lead may cause elevated levels.

The following general table divides fruit and vegetables into broad classes according to how strongly they take up heavy metals in soils.

FRUIT AND VEGETABLE UPTAKE OF HEAVY METALS ¹¹

High	Moderate	Low	Very low
Lettuce	Onion	Corn	Beans
Spinach	Mustard	Cauliflower	Peas
Carrot	Potato	Asparagus	Melon
Endive	Radish	Celery	Tomatoes
Cress		Berries	Fruit
Beet			Paprika
Leaves (beet)			

The actual uptake is specific for the metal and the species of vegetable or fruit. However, the table may be useful for some gardeners as a general guide when assessing their own situation.

A number of gardening practices can also reduce heavy metal uptake by vegetables. Phosphate fertilizers may contain elevated cadmium levels and these should be avoided. A soil pH of 6.2 – 6.7, achieved through the use of lime, will reduce uptake of metals by vegetables. Maintaining a higher organic and clay content in the soil can also be beneficial.

Conclusion

In parts of Lutana and Hobart’s eastern shore, elevated levels of lead, cadmium and zinc in soil have been identified that are attributable to historical dust blown from the Hobart zinc smelter. The deposition of this dust in surface soils has also resulted in elevated levels of lead and cadmium in some home-grown vegetables, primarily leafy greens.

Health risk modelling has previously indicated that some sectors of the community could be at increased risk of metals uptake as a result of this contamination; however, direct health measurements of actual human exposure to these contaminants have indicated that health impacts are not occurring.

The uptake of lead and cadmium in residents in the area has been shown to be similar to control areas and national averages. Nevertheless, the Director of Public Health has recommended simple precautionary measures that can further reduce any risk from the contamination. These precautions, while sensible for anyone living in an urban environment, are specifically recommended for those living in the area where the Health Investigation Levels A are exceeded.

Ongoing contact with the community

A Project Steering Committee, comprised of members representing the Environment Protection Authority, the Department of Health and Human Services, three local Councils, and members of the affected community, has been formed and is working on ways to ensure the community are kept informed on the issue, and specifically the recommendations outlined in the Information Bulletin.

To ensure new residents are informed, Councils will attach an information note to the section 337 certificates issued during conveyancing.

Questions in relation to health issues should be directed to the DHHS on 1800 671 738. Questions relating to soil contamination or specific to Nyrstar Hobart operations may be directed to the EPA on 6233 6518.

Anyone with specific concerns about their personal health should contact their general practitioner.

The public is also encouraged to contact Nyrstar Hobart directly with any questions, or attend one of their quarterly community meetings.

References

1. "Managing soil Contamination in parts of Lutana and Hobart's eastern shore", May 2009, Tasmanian Government.
2. "Environmental and Human Exposure Surveys in the Vicinity of the Pasminco-EZ Refinery: Final Summary report", John Meidecke and Partners Pty Ltd/ Environmental Geochemistry International Joint Venture and the Menzies Centre for Population Research, August 1992.
3. "Investigation of Heavy Metals in Indoor Dust, Soils and Home-Grown Vegetables – Investigations in the vicinity of the Pasminco-EZ refinery, Hobart", Aquahealth, University of Tasmania, Hobart, October 1995
4. "1997 Blood Lead Survey of children living in the environs of the Pasminco-EZ refinery", Menzies Centre for Population Health, University of Tasmania.
5. "Soil sampling surrounding Nyrstar Hobart Zinc Works, Lutana and eastern shore suburbs – 2008" prepared by Sinclair Knight Merz Pty Ltd, 6 December 2008.
6. FSANZ (Food Standards Australia New Zealand) Australia New Zealand Food Standards Code, Standard 1.4.1, Contaminants and Natural Toxicants. 2005.
7. 1997 Blood Lead Survey of children living in the environs of the Pasminco EZ refinery, Menzies Centre for Population Research, University of Tasmania.
8. Review of materials relating to soil contamination surrounding the Nyrstar Hobart Pty Ltd smelter, Prof. M.J. McLaughlin, Centre for Environmental Contaminants research, CSIRO Land and Water, 8 December 2008.
9. Review of 2008 data relating to soil contamination surrounding the Nyrstar Hobart Pty Ltd smelter, Prof. M.J. McLaughlin, Centre for Environmental Contaminants research, CSIRO Land and Water, 9 February 2009.
10. National Environment Protection Measure (Assessment of Site Contamination) Measure 1999, Schedule B(1) Guideline on Investigation Levels for Soil and Groundwater
11. European Chemical Industry Ecology & Toxicology Centre (1990). Hazard assessment of chemical contaminants in soil. ECETOC. Belgium. Technical Report No 40.

References 2, 3, 5, 8 and 9 are available to review at the Department of Primary Industries and Water Library at 134 Macquarie Street Hobart and at the State Library of Tasmania.