Drivers of Priority Setting in Environmental Health

Dr Deborah Read

December, 2006

Outline

- Risk
- Case studies
  - Lead
  - Organochlorines
- Summary of current response
- Conclusion

What is Risk?

- Magnitude of adverse effect x probability of occurrence
    - (Hazardous Substances and New Organisms (Methodology) Order, 1998)

Risk =

Hazard

*

Outrage

Hazard + outrage (Sandman, 1991)

People's Response to Risk

- Complex
- Multi-dimensional
- Diverse
- Means different things to different people and in different contexts
- Reflects differing assumptions, values and stakes in risk issues
- Difference between public and experts on comparative significance of risks

Why do Risk Perceptions of Public and Experts Differ?

- Different definitions of the concept of risk
- Public expands the concept to include various attributes
- Public view:
  - reflects legitimate concerns that are typically omitted from technical risk assessments
  - sometimes lack certain information about hazard
  - respond more to qualitative aspect (outrage) than to quantitative aspect (hazard)

Key Attributes of High Risk (High Outrage)

- involuntary
- industrial
- uncontrollable
- immoral
- unfamiliar
- dread
- uncertain
- catastrophic
- memorable
- unfair
- untrustworthy
- unknowable
- unresponsive process

Other Attributes of High Risk

- Affects vulnerable populations
- Delayed effects
- Risk to future generations
- Identifiable victims
- Not preventable
- Benefits not highly visible, few or inequitable
- Considerable media coverage

Risk = Hazard + Outrage

Lead

Non-occupational Lead Exposure

- Lead-based paint on and around houses built pre-1970, particularly pre-1945, is main source
- Para-occupational
- ‘Hot spots’ e.g. corridors of heavily trafficked roads, former horticultural land
- Hobbies e.g. indoor rifle shooting
- Industrial point source e.g. Petone smelter

What is Known?

- Environmental data
  - Significantly higher on pre-1975 horticultural land; post-1975 properties not above guideline level (Gaw, 2001)
  - Likely around older houses and generally increases with house age
    - 79% soil samples older housing areas > 300 ppm (investigation level) (Bates et al, 1994)

What is Known?

- General population exposure data
  - Levels declining – low dietary intake (NZFSA, 2005)
  - Estimated geometric mean children < 5 years 3.7 µg/dl (RPH, 2005)
    - 1999 US NHANES 1-5 years 2.0 µg/dl

Lead Absorption

- Notification level 15 µg/dl (0.72 µmol/l) since 1996
- Annual notifications fluctuate
- 2005 71 notifications (1.9 per 100,000) - includes 6 children <15 years

Under-recognition in children?

Health Effects

- Continuum of health effects
- Effects on most systems e.g. cardiovascular, haematological, renal
- Irreversible cognitive effects in young children (including fetus) at low dose – threshold not known
- Increased susceptibility of children - greater absorption; behaviour; sensitivity of developing nervous system

Effects of Lead on Cognitive Development

- Inverse association between PbB and cognitive function in children at successively lower PbB
- Greater deficits at levels < 10 µg/dl
  - Canfield *et al* (2003); Bellinger and Needleman (2003); Lanphear *et al* (2005); Schnaas *et al* (2005)

Other Effects of Low Lead Exposure

- Small increases in blood pressure
- Affects haem biosynthesis
- Suggestive evidence of other effects

  e.g. reduced gestational age, reduced birth weight, peripheral arterial disease


EXIDE
50

Exide Lead Battery Recycling Plant

- Exide Technologies Ltd, Petone only remaining lead battery recycling plant in New Zealand
- Secondary lead smelting and lead refining at site since 1965
- Fugitive emissions are dominant lead dust source
- Neighbours include residents

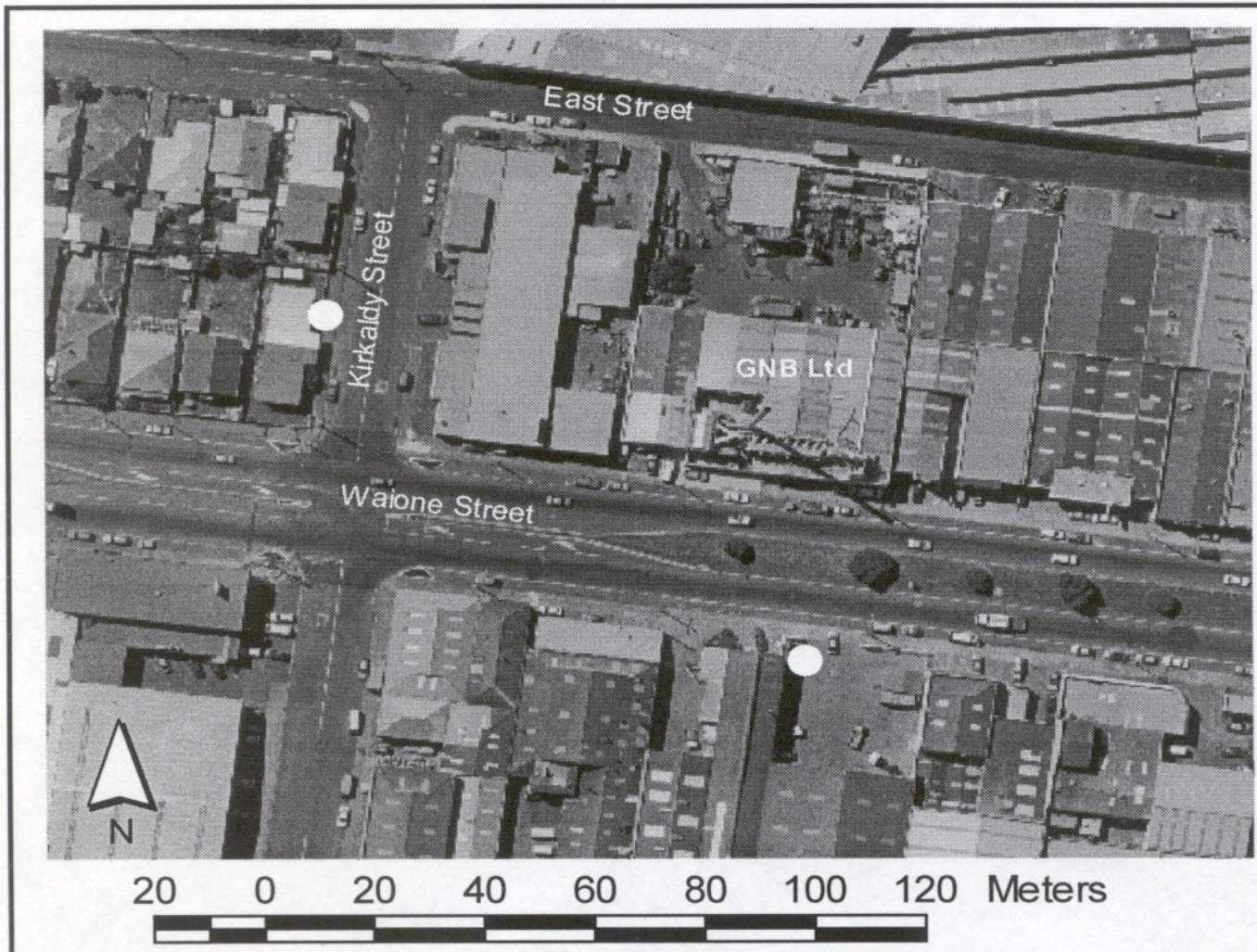
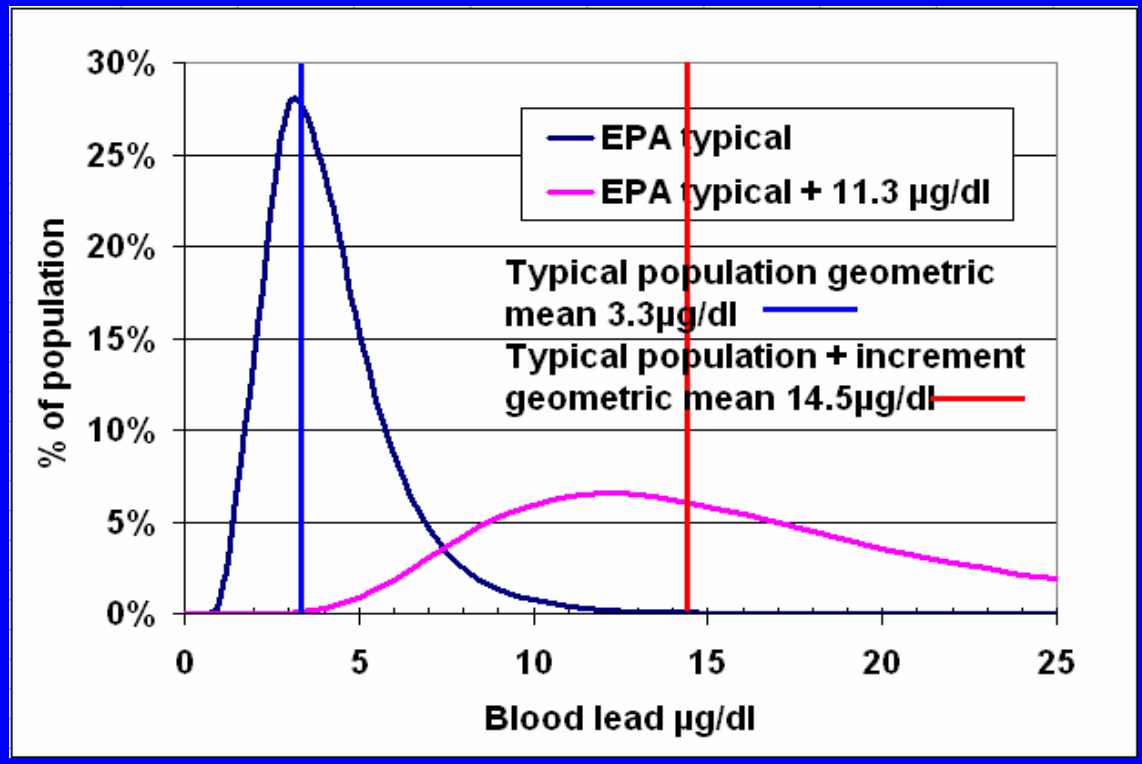


Figure 2.2 Site Layout and Location of Samplers (O)

Background

- 2001 Regional Council granted an air discharge permit for 10 years
- Requirement for lead deposition monitoring as well as air monitoring
- Subsequent modelling estimated average blood lead increment of 11.3 ug/dl for closest children

IEUBK Model's Predicted Children's Blood Lead Levels for Lead Emissions



Resource Consent Review

- 2005 resource consent review requested by Regional Public Health
- Recommended boundary control limits be set
- Calculated lead in air levels corresponding to limits on deposition rate and hence concentration of lead in deposited dust
  - based on limiting population mean PbB increment to 1 µg/dl and IQ decrement to 1 point

What Happened?

- Community awareness
  - letters to residents, formation of Exide Pollution Action Group, public meeting, media
- Low uptake of blood lead testing and soil lead testing
- Regional Council decision
  - set boundary control limits
- Appeals to Environment Court
  - 2006 GWRC decision confirmed

Risk = Hazard + Outrage

Organochlorines

Organochlorines in New Zealand

- Dioxins - polychlorinated dibenzo-*p*-dioxins, polychlorinated dibenzofurans, certain polychlorinated biphenyls

- Organochlorine pesticides - e.g. DDT, dieldrin, hexachlorobenzene, chlordane, lindane, PCP

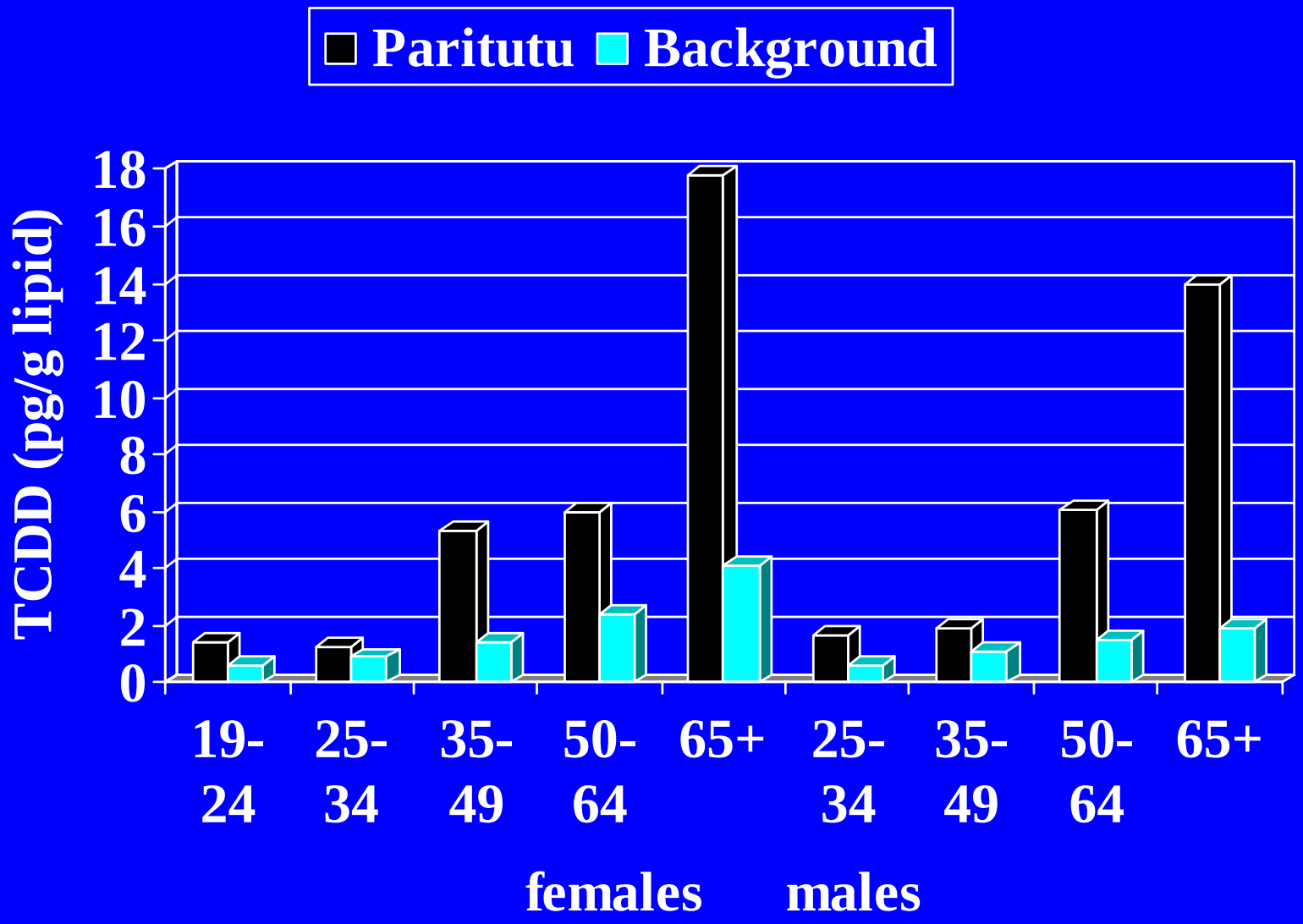
What is Known?

- Environmental data
  - Low concentrations in air, soil, sediment, water, avian and aquatic biota (MfE, 1998-2000)
  - ‘Hot spots’ e.g. former horticultural land, sheep-dip sites
- General population exposure data
  - Low dietary intake (MfE, 1998)
  - Low serum levels except DDE similar (MfE, 2001)

What is Known?

- Occupational dioxins exposure data
  - agricultural sprayers (2,4,5-T)
  - timber treatment workers (PCP); IWD workers (2,4,5-T) (in progress)
- Paritutu dioxins exposure data

Mean TCDD by Age and Gender (ESR, 2005)



New Zealand Trends

- Reduction in emissions from late 1980s
- Levels declining e.g. breast milk 1987/8-1997/8; 2006/7?

Health Effects

- DDT
  - limited human data: effects on nervous system and liver; cancer?
  - animal data: effects on liver (including cancer), adrenal gland, reproduction and development

Health Effects

- Dieldrin
  - human data: effects on nervous system; cancer?
  - animal data: effects on nervous system, liver, immune system, reproduction and development; cancer

Health Effects

- TCDD (‘dioxin’)
  - human data: chloracne; cancer
  - animal data: effects on immune system, reproduction and development; cancer

Current Situation: Lead

- National Environmental Standards (air quality)
- DWSNZ 2005 - biannual advice about plumbosolvent water
- Proposed reduction of non-occupational notification level to 10 µg/dl (0.48 µmol/l); occupational notification level needs revision
- No NZ risk-based soil guideline level

Current Situation: Organochlorines

- NZ risk-based soil guideline levels for TCDD (though needs revision) but not for DDT or dieldrin
- National Environmental Standards (air quality) - ban certain activities (dioxin)
- Dioxin Action Plan - dioxin release reduction

	Dioxin	Lead
Environmental persistence	yes	yes
Human evidence	sufficient for 5 conditions	sufficient for many
Human carcinogen	yes	probable
Susceptibility of children	?	yes
Threshold	?	no
Public concern	high	low

Conclusion

Need to respond to low as well as high outrage environmental health issues to achieve improvement and protection of public health in New Zealand

Which is the leading driver – hazard or outrage?