

# Orica Mercury Independent Review

Stage 2 – Environmental Testing  
Interim Results for Public Lands



# Project Objectives



- Collection of a robust dataset for future risk assessment if needed;
- Assess risk to community of mercury, Polychlorinated Biphenyls (PCB), Polycyclic Aromatic Hydrocarbons (PAH), lead and/or chromium;
- Assess sources of community exposure to mercury that are not currently being managed/controlled;
- Identify communities and/or individuals at risk; and
- Assist in reassuring the community.



# Overview of scope

- Conduct testing of public lands
- Testing for mercury in:
  - Soil
  - Vapour/air
  - Sediment of Penrhyn Estuary
  - Fish (Biota) in Penrhyn Estuary

## Soil Investigations – Scope completed

- 148 boreholes described;
  - 76 boreholes in parks
  - 72 on road verges

[www.vanwalt.com](http://www.vanwalt.com)



# Soil Investigations – Locations Tested for Mercury





## Soil Investigations – Scope completed

- 2 samples collected per hole\*
  - Surface (0-0.05m)
  - Depth (0.4-0.5m)
- Analysis of 295 samples for mercury.

[www.vanwalt.com](http://www.vanwalt.com)

\* One borehole had only one sample collected as it could only be advanced 0.2m

# Soil Investigations – Guidelines Adopted

## → NEPM, 2013

- National guideline for environment protection;
- Criteria for all key chemicals tested;

Criteria	Standard Residential	Public Open Space
Units	mg/kg	mg/kg
Mercury -inorganic	40	80





# Soil Investigations – Guidelines Adopted

→ NEPM, 2013

- National guideline for environment protection;
- Criteria for all key chemicals tested;

Criteria	Standard Residential	Public Open Space
Units	mg/kg	mg/kg
Mercury -inorganic	40	80





# Soil Investigations – Results for Mercury

→ All results less than the adopted criteria for Standard Residential.

Chemical	Number of tests	Max mg/kg	Avg mg/kg	95%UCL mg/kg
Criteria	-	40 (Standard Residential)		
		80 (Parks and Open Spaces)		
Topsoil Mercury	148	4.7	0.24	0.35
Subsoil Mercury	147	2.7	0.14	0.23





# Soil Investigations – Lead, Chromium, PAH & PCB





# Soil Investigations – Results for other chemicals

→ All results less than adopted criteria for Standard Residential scenarios

Chemical	Number of tests	Max mg/kg	Avg mg/kg	95%UCL mg/kg
Lead	Criteria	300 (Standard Residential)		
		600 (Parks and Open Spaces)		
	17	209	74	96
Chromium (III+VI)	Criteria	100 (Standard Residential)		
		300 (Parks and Open Spaces)		
	17	12	5.6	6.7



# Soil Investigations – Results for other chemicals

→ All results less than adopted criteria for Standard Residential scenarios

Chemical	Number of tests	Max mg/kg	Avg mg/kg	95%UCL mg/kg
Total PAHs	Criteria	300 (Standard Residential)		
		600 (Parks and Open Spaces)		
	17	19.9	2.8	-
Benzo(a) Pyrene TEQ	Criteria	3 (Standard Residential)		
		3 (Parks and Open Spaces)		
	17	2.6	0.51	-





# Soil Investigations – Results for other chemicals

→ All results less than adopted criteria for Standard Residential scenarios

Chemical	Number of tests	Max mg/kg	Avg mg/kg	95%UCL mg/kg
Total PCBs	Criteria	1 (Standard Residential)		
		1 (Parks and Open Spaces)		
	17	<0.1	-	-





## Mercury Vapour – Scope Completed

- 19 Stormwater pits:
  - Within pit;
  - At pit entrance; and
  - At 1m above pit.
- 148 borehole locations:
  - At soil surface; and
  - At 1m above surface.





# Mercury Vapour – Guidelines Adopted

- WHO, 2000
  - Annual average (for comparison)
- WHO, 2002
  - Tolerable concentration for long term inhalation (adopted criteria)

Criteria	Annual Average	Long Term Inhalation
Units	$\mu\text{g}/\text{m}^3$	$\mu\text{g}/\text{m}^3$
Mercury Vapour	1	0.2



# Mercury Vapour – Guidelines Adopted

- WHO, 2000
  - Annual average (for comparison)
- WHO, 2002
  - Tolerable concentration for long term inhalation (adopted criteria)

Criteria	Annual Average	Long Term Inhalation
Units	$\mu\text{g}/\text{m}^3$	$\mu\text{g}/\text{m}^3$
Mercury Vapour	1	0.2





# Mercury Vapour – Results Summary

→ All results less than WHO tolerable concentration for long term inhalation

Chemical	Number of tests	Max $\mu\text{g}/\text{m}^3$	Avg $\mu\text{g}/\text{m}^3$	95%UCL $\mu\text{g}/\text{m}^3$
Criteria	-	0.2		
Inside Pits	19	0.034	0.02	0.02
At surface	172	0.074	0.02	0.03
1m above surface	176	0.076	0.02	0.04



# Sediment Testing – Scope Completed

- Objective to assess current levels of mercury in the surface sediments of Pehnryn Estuary;
- 20 samples collected:
  - 12 from a boat;
  - 2 from kayak;
  - 6 direct grabs at low tide
- All samples analysed for Total Mercury
- Methyl mercury tested on two most elevated results



# Sediment Testing – Guidelines Adopted

- ANZECC, 2000
  - Interim Sediment Quality Guidelines
    - Low
    - High
  - Ecological threshold
- NEPM, 2013
  - Open Space Criteria (Health based criteria for comparison)

Criteria	ISQG - Low	ISQG - High	Public Open Space
Units	mg/kg	mg/kg	mg/kg
Mercury	0.15	1.0	80



# Sediment Testing – Guidelines Adopted

- ANZECC, 2000
  - Interim Sediment Quality Guidelines
    - Low
    - High
  - Ecological threshold
- NEPM, 2013
  - Open Space Criteria (Health based criteria for comparison)

Criteria	ISQG - Low	ISQG - High	Public Open Space
Units	mg/kg	mg/kg	mg/kg
Mercury	0.15	1.0	80





# Sediment Testing – Results Summary

- 9 Results greater than ISQG - Low
- All results less than ISQG - High
- All results less than Public Open Space Criteria
- Both Methyl Mercury results non-detect.



Chemical	Number of tests	Max mg/kg	Avg mg/kg	95%UCL mg/kg
Criteria	-	0.15 (Low ISQG Threshold)		
		1.0 (High ISQG Threshold)		
Mercury - inorganic	20	0.9	0.2	0.3
Methyl Mercury	2	<0.1	<0.1	-



# Sediment Testing – Test Locations and Results





# Biota Assessment - Program and Guidelines

- Objective to assess current mercury levels in middle topic biota (fish);
- Outsourced to Ecosure (permits and Animal Ethics Committee approvals);
- Designed to mirror previous work for comparability of results.
- Guidelines from ANZFA, 2011

Criteria	Fish	Predatory Fish
Units	mg/kg	mg/kg
Mercury	0.5	1

# Biota Assessment - Program and Guidelines

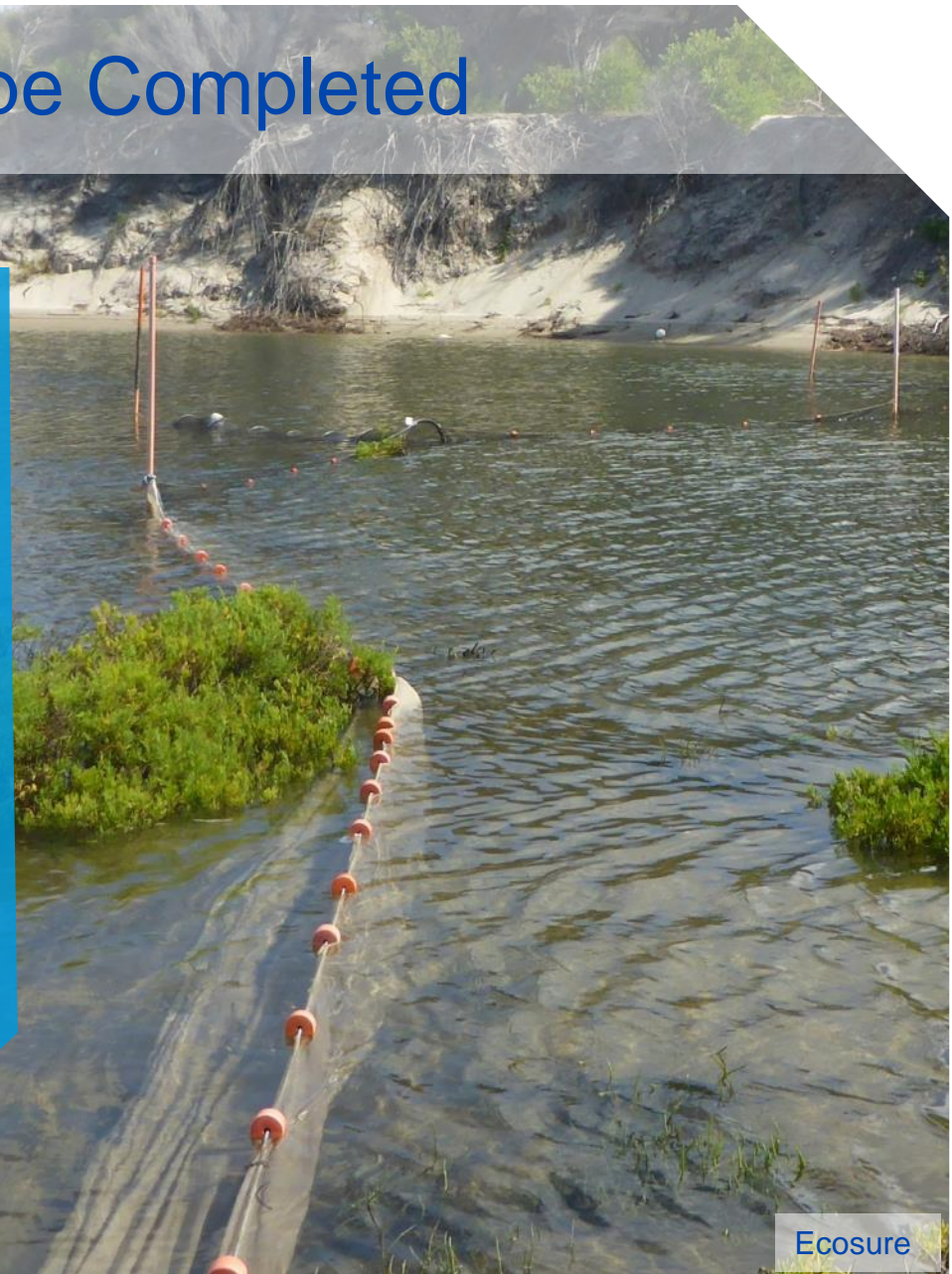
- Objective to assess current mercury levels in middle topic biota (fish);
- Outsourced to Ecosure (permits and Animal Ethics Committee approvals);
- Designed to mirror previous work for comparability of results.
- Guidelines from ANZFA, 2011

Criteria	Fish	Predatory Fish
Units	mg/kg	mg/kg
Mercury	0.5	1



## Biota Assessment – Scope Completed

- Fish sampling in the Estuary:
  - active (seine nets, hand reels)
  - passive (fyke nets).
- Collected:
  - 10 sea mullet
  - 10 toad fish
  - 8 whiting
  - 4 silver biddy
  - 2 luderick
  - 1 yellow fin bream
- Samples analysed for Mercury



Ecosure

# Biota Assessment – Results Summary

- All results less than ANZFA food standard for Mercury (0.5mg/kg)
- Maximum was 0.3mg/kg in the bream sample
- Averages for other species ranged from 0.056mg/kg (sea mullet) to 0.175 mg/kg (luderick)
- Generally a significant positive correlation between fish size and mercury concentration.
  - Sea mullet was the exception with a significant negative correlation
- Generally a significant reduction in mercury since 2004.
  - Sea mullet again the exception.





## Findings...

- All soil results from 148 locations were less than Residential criteria.
- All vapour testing results from drains and soils were less than WHO levels
- Surface sediment concentrations are improving.
- All fish results were less than food guidelines and appear to be improving with time.



# Thanks for Listening!

