



2nd KAMPAI Joint Coordination Committee Meeting

16th October 2017 – Lusaka, Zambia

**Heavy metal concentrations, stable lead (Pb) isotope ratios
and variation of selected biomarkers in human milk, hair,
blood, urine and fecal samples from the vicinity of the lead-
zinc mine in Kabwe, Zambia**

**Output 2 - Activity Report and Future Plan
By YABE John – Research Manager**

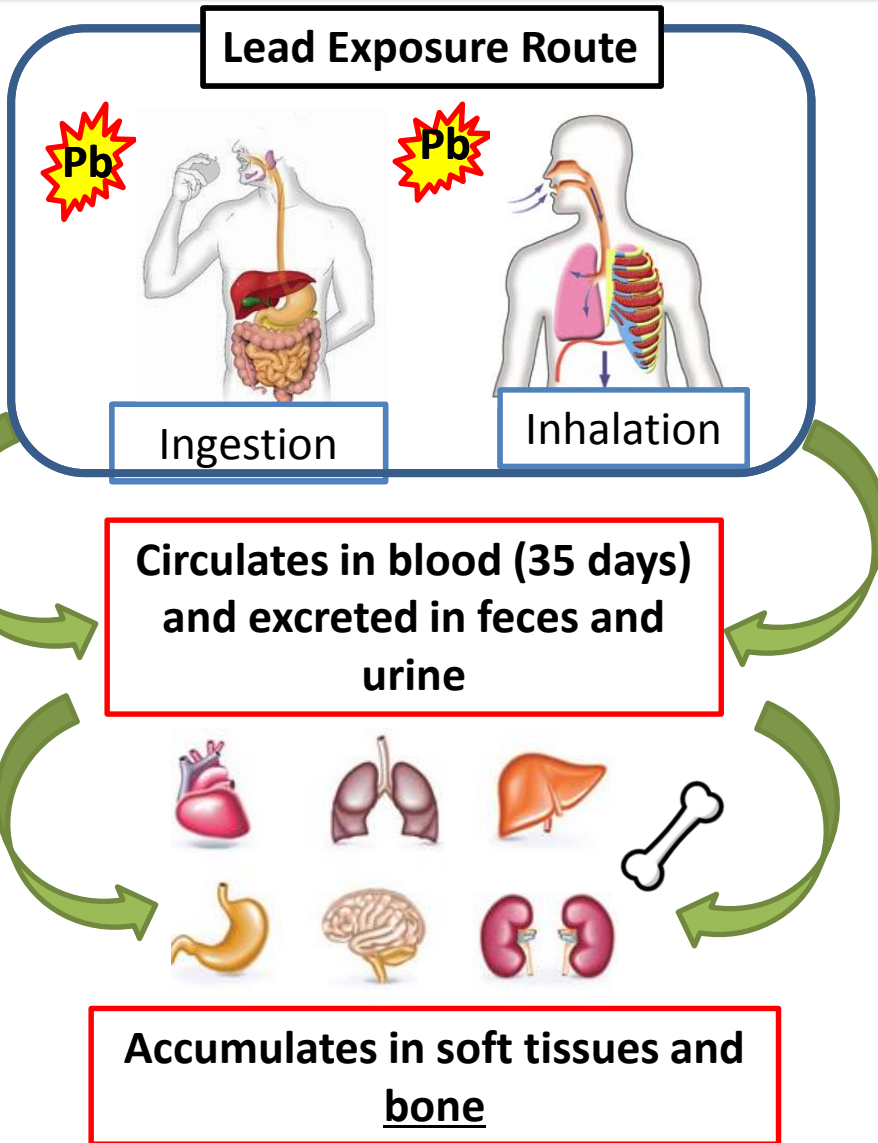
Collaborative research between the University of Zambia and Hokkaido University (Japan)

Funding: JICA and JST

Duration: 2016-2020

Site: Kabwe City, Central Province, Zambia

Lead metabolism and critical BLLs



		Blood Lead Levels (BLLs)	
Children		BLLs (µg/dL)	Adults
	Death →	150	← Encephalopathy ← Nephropathy
	Encephalopathy → Nephropathy → Frank Anemia →	100	← Frank anemia
		50	← Male Reproductive Effects ← ↓Hemoglobin Synthesis and Female Reproductive Effects
	↓ Hemoglobin Synthesis →	40	Chelation therapy
	↓ Vitamin D Metabolism →	30	← Elevated Blood Pressure
	↓ Nerve Conduction Velocity → ↑ Erythrocyte Protoporphyrin → ↓ Vitamin D Metabolism(?) →	20	← ↑Erythrocyte Protoporphyrin (men) ← ↑Erythrocyte Protoporphyrin (women)
	Developmental Toxicity → ↓ IQ, ↓ Hearing, ↓ Growth	10	
	Transplacental Transfer →	5	

Clinical signs/symptoms are non specific
Clinical diagnosis of lead poisoning is difficult

Output Two Objectives

- Measuring blood Pb concentrations in mother (venous and cord blood) and child pairs in Kabwe
- Measuring Pb levels (blood, urine and feces) in children
- Measuring Pb concentrations in breast milk
- Measuring biomarkers to determine the effects of exposure
- Neurodevelopment assessment of Pb exposure in children
- Cognitive assessment – IQ analysis
- Assessing effects of Pb on Quality of Life
- Assess the socio-economical impact of Pb pollution in Kabwe



WORLD BANK

Treatment



Remediation



**PURE
EARTH**

BLACKSMITH INSTITUTE

Blood screening Oct 2016 – Post remediation

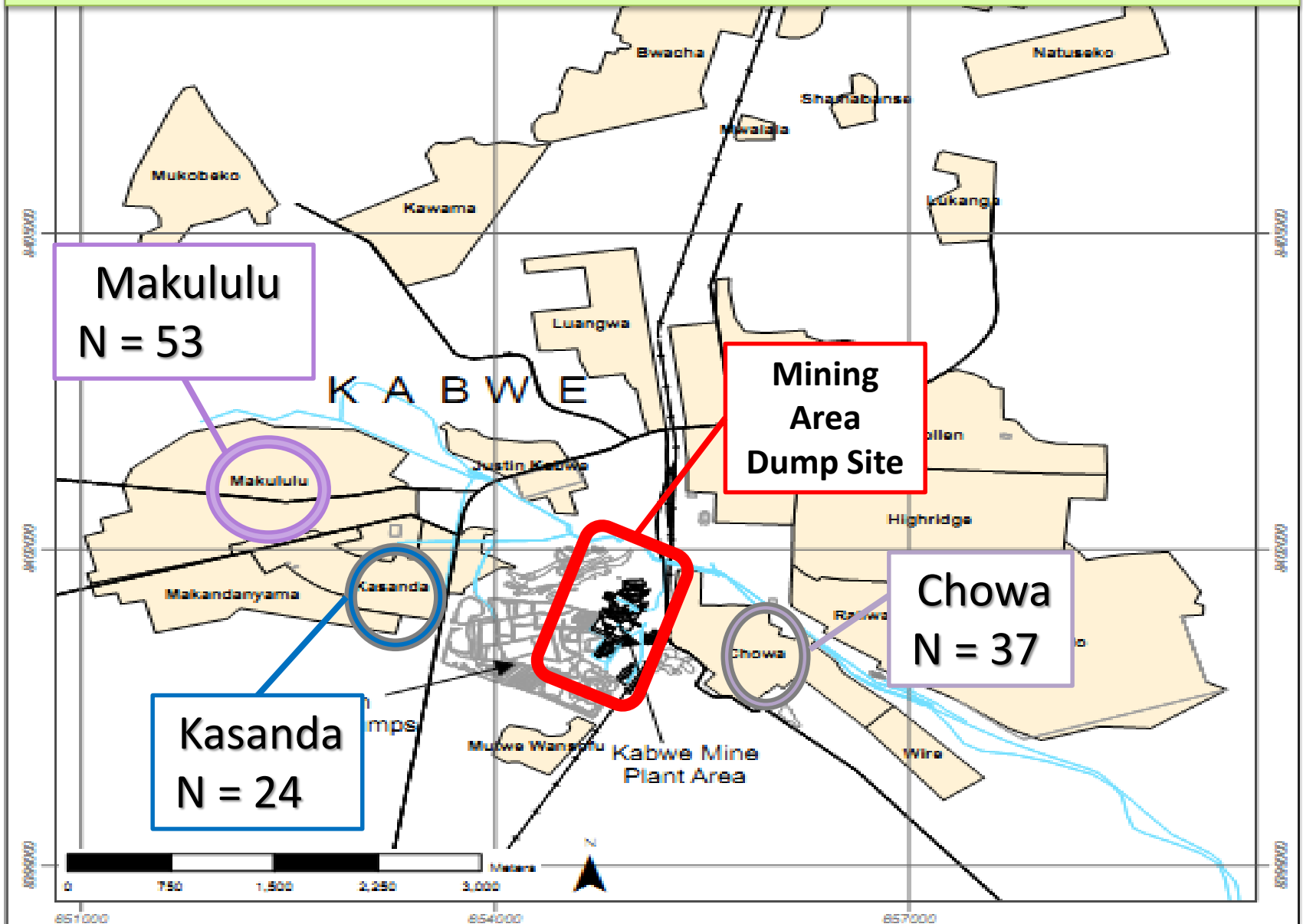


Figure 2.2.med

BLL measurements – LeadCare II



- 2016 BLLs results in 3 townships
- ☞ 114 blood samples (both boys and girls)
- ☞ Children up to 10 years old
- ☞ BLLs ranged from 7.80 – 64.3 µg/dL
- ☞ BLLs exceeded the CDC guideline (5µg/dL)
- ☞ Negative correlations between age and BLL

Output Two – Activities (Jan – August 2017)



Blood sampling protocol

【Father & Mother】



5 mL with heparin



Child above 5 years



5 mL with heparin



Transfer



Child less than 5 years



2 mL with heparin



Transfer



Transfer: 1.5 mL × 2 tubes
(in 2 mL tube)

【Pb conc. & Isotope analysis】

LeadCare II



【BLL measurement】
(using only 50 μL)



2 mL of
remaining blood

Centrifuge
(4000 rpm, 10 min)



Plasma Transfer
0.5 mL × 1 tube
(in 1.5 mL tube)

【Blood biochemistry】



Transfer: 1.5 mL × 1 tubes
(in 2 mL tube)

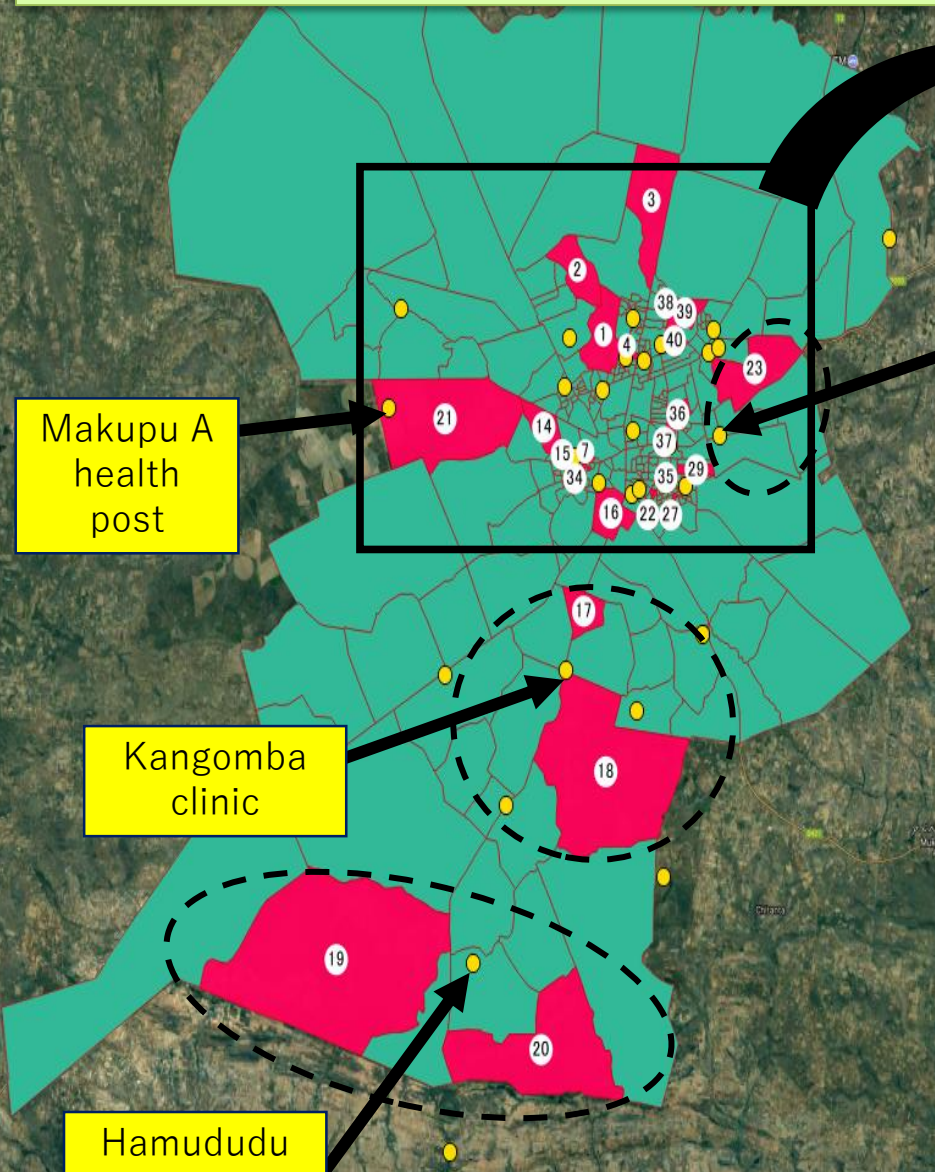
【Pb conc. & Isotope analysis】

LeadCare II



【BLL measurement】
(with only 50 μL)

July to August 2017 - Sampling Sites



Mpima prison clinic



Samples collected (July – August 2017)

Sample	300µL blood	1.5 mL	1.5 mL	Plasma	ER	Urine	Fecal
Tube type	2 mL tube	2 mL tube	2 mL tube	1.5 mL tube	1.5 mL tube	15 mL tube	30 mL tube
Total	1239	1220	1107	1013	1013	1005	393

- BLLs results in 40 areas
- ☞ Minimum - ND
- ☞ Maximum – 162.3 µg/dl
- ☞ Average – 21.8 µg/dl

- Critical levels
- ☞ > 5 µg/dl – 882 (69%)
- ☞ >45 µg/dl – 188 (15%)
- ☞ > 60 µg/dl – 80 (6%)

On-going and future plans

- **Sample analysis**

- MTA application for July-August samples to be done
- Official reports of results is on-going

- **Neurodevelopment - School of Public Health**

- Children below the age of 3
- Assessment on-going

- **Cognitive and IQ assessment - Special Education, School of Ed**

- School going children above the age of 3
- Assessment still at planning stage

- **Socio-economic assessment – Economics Department, School of HSS**

- Households have been identified
- Assessment on-going

Achievements and challenges

- **Broad surveillance**

- Conducted successfully
- BLL measurements done with LeadCare II

- **Ethical clearance and MTA**

- Expired on 30th August 2017
- Applied for renewal and granted
- MTA application granted for Oct 2016 and Jan-May 2017 samples

- **Collaborations**

- PureEarth - Obtained 2014 BLL results and using their LeadCare II
- World Bank - Held joint meetings, MOU being drafted

- **Challenges**

- Sample size – not met during broad surveillance
- Participants expecting treatment and thus affecting response