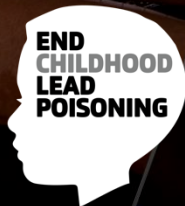


Conducting a Risk Assessment

Ending Childhood Lead Poisoning Webinar Series

27 January 2024



**PARTNERSHIP FOR
A LEAD-FREE FUTURE**

Proposed Webinars

Webinar #	Date	Topic
Webinar 1	21-Oct-24	Understanding sources of lead exposure
Webinar 2	25-Nov-24	Carrying out a Blood Lead Level survey
Webinar 3	27-Jan-25	Conducting an environmental risk assessment
Webinar 4	24-Feb-25	Developing country strategies on lead exposure
Webinar 5	31-Mar-25	Communicating on childhood lead poisoning
Webinar 6	28-Apr-25	Developing Health Systems capacity on lead poisoning
Webinar 7	26-May-25	Building lead surveillance system
Webinar 8	30-Jun-25	Regulatory frameworks
Webinar 9	28-Jul-25	Occupational exposure
Webinar 10	29-Sep-25	Developing environmental ministry capacity
Webinar 11	20-Oct-25	Used Lead Acid Batteries
Webinar 12	24-Nov-25	Remediation

Today's Speakers



**Youth ambassador
Zeineldin Elmikaty, 5th
year Egyptian Medical
Student**



**Larah Ortega-
Ibañez, Country
Director,
Philippines for
Pure Earth**



**Dr. Casey Bartrem,
Executive Director and
Senior Environmental
Scientist at
TerraGraphics
International
Foundation (TIFO),**

Lead Exposure in Egypt: A Crisis

Zeineldin Elmikaty

5th Year Medical Student and IFMSA Public Health International Team Member



Medical
Students
Worldwide

Lead Exposure Stories from Alexandria's University Hospital



Lead Exposure: Children Working



Lead Exposure: Industrial Areas & Manshyet Naser



Lead Exposure: Urban Cities and High-traffic Areas



The Role of IFMSA and Youth Advocacy

- A world in which all medical students unite for global health, and are equipped with the knowledge, skills and values to take on health leadership roles locally and globally.



For further inquiries,
please contact us at
email@ifmsa.org

-
-  ifmsa.org
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Lead Exposure Risk Assessment: Key Approaches and Considerations from PE PH Experience

Larah Ortega – Ibañez

Country Director, Pure Earth Philippines

larah@pureearth.org

www.pureearth.org

The Pure Earth Way

Collaborate

Government
Industry
Academe
CSOs

Identify and Implement

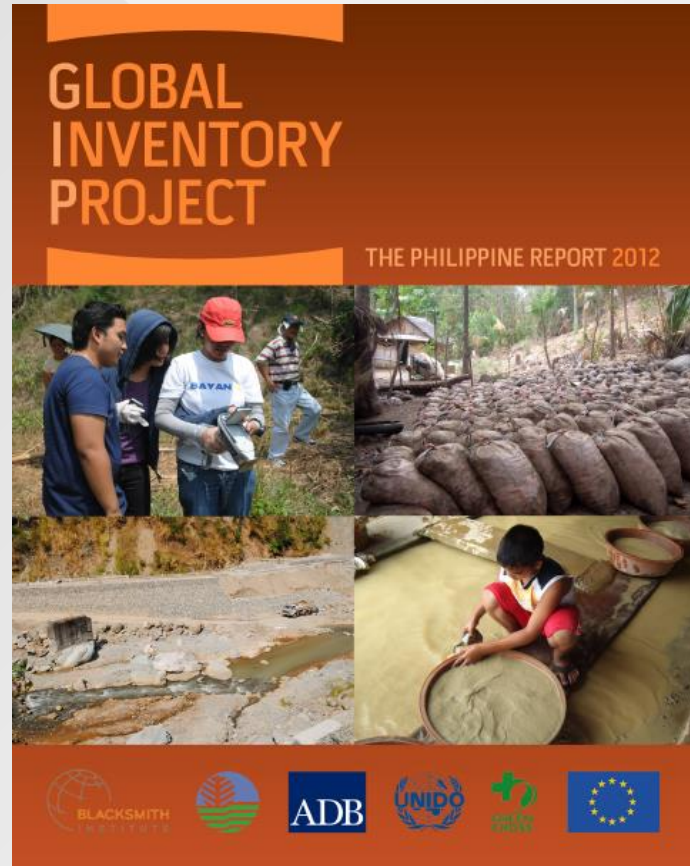
Solutions, Sound Data
Cost-effective
Sustainable
Impact

Prioritize

Stopping toxic exposures
Protecting health
Restoring environments
In LMICs

Key Approaches

Global Inventory Project



- Key Industries**
- Agriculture
 - Artisanal Mining (hand mining)
 - Ceramics (lead glaze)
 - Chemical Manufacturing (acids, organics, base chemicals)
 - Dye Industry
 - E-waste recycling
 - Industrial Estate (mixed industries)
 - Industrial/Municipal Dump Site
 - Lead - Battery Recycling
 - Lead Smelting (with ingot production)
 - Medical (hospitals, clinics)
 - Mining and Ore Processing
 - Multiple Diverse Industries
 - Naturally Occurring
 - Other
 - Petrochemical industries (refineries)
 - Power Plants (coal or oil)
 - Product Manufacturing (electronics, equipment, clothing)
 - Recycling / Recyclers (including salvage yards)
 - Wastewater Treatment Plant
 - Philippines

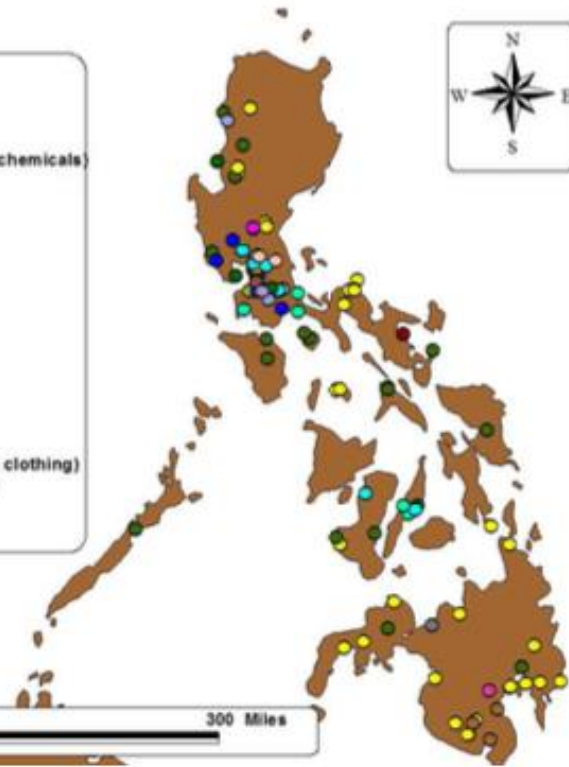


Figure 3. Key polluting industries in the GIP sites assessed in the Philippines

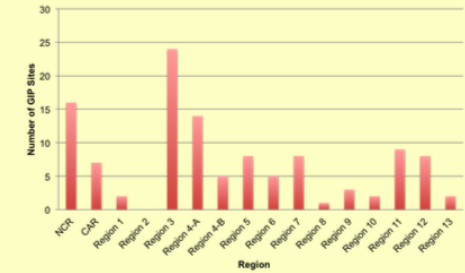


Figure 1. GIP sites assessed per region

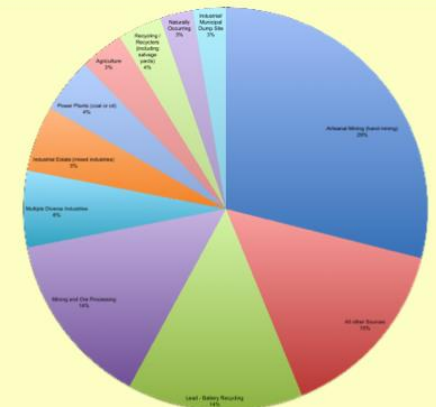
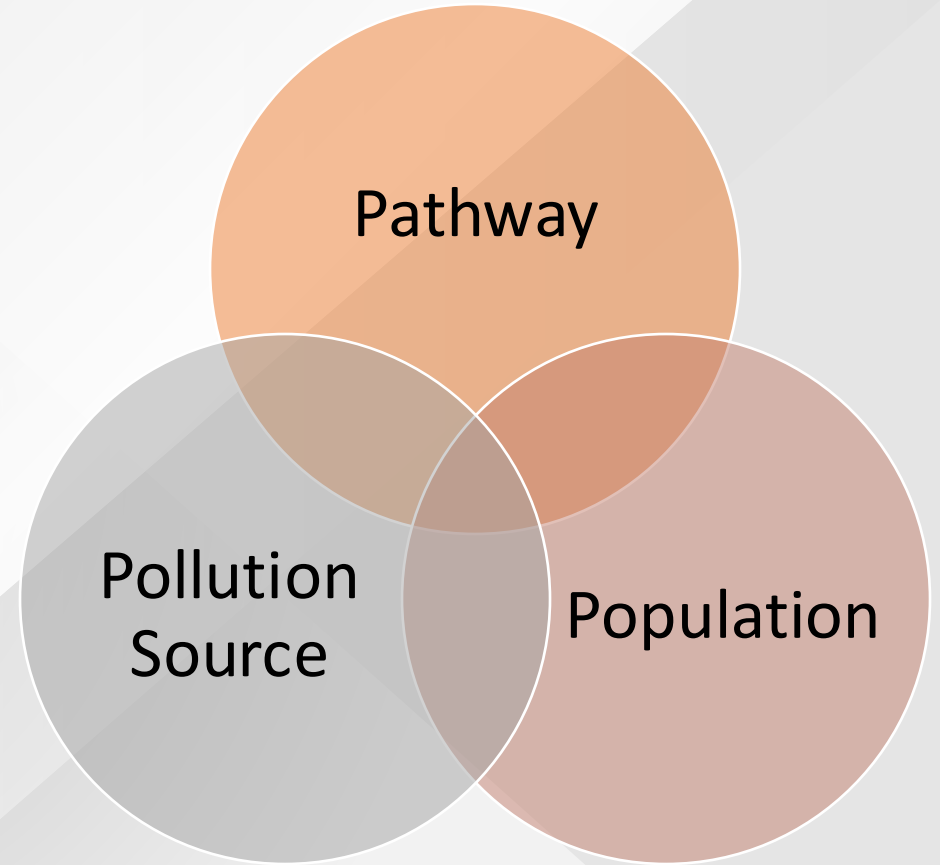
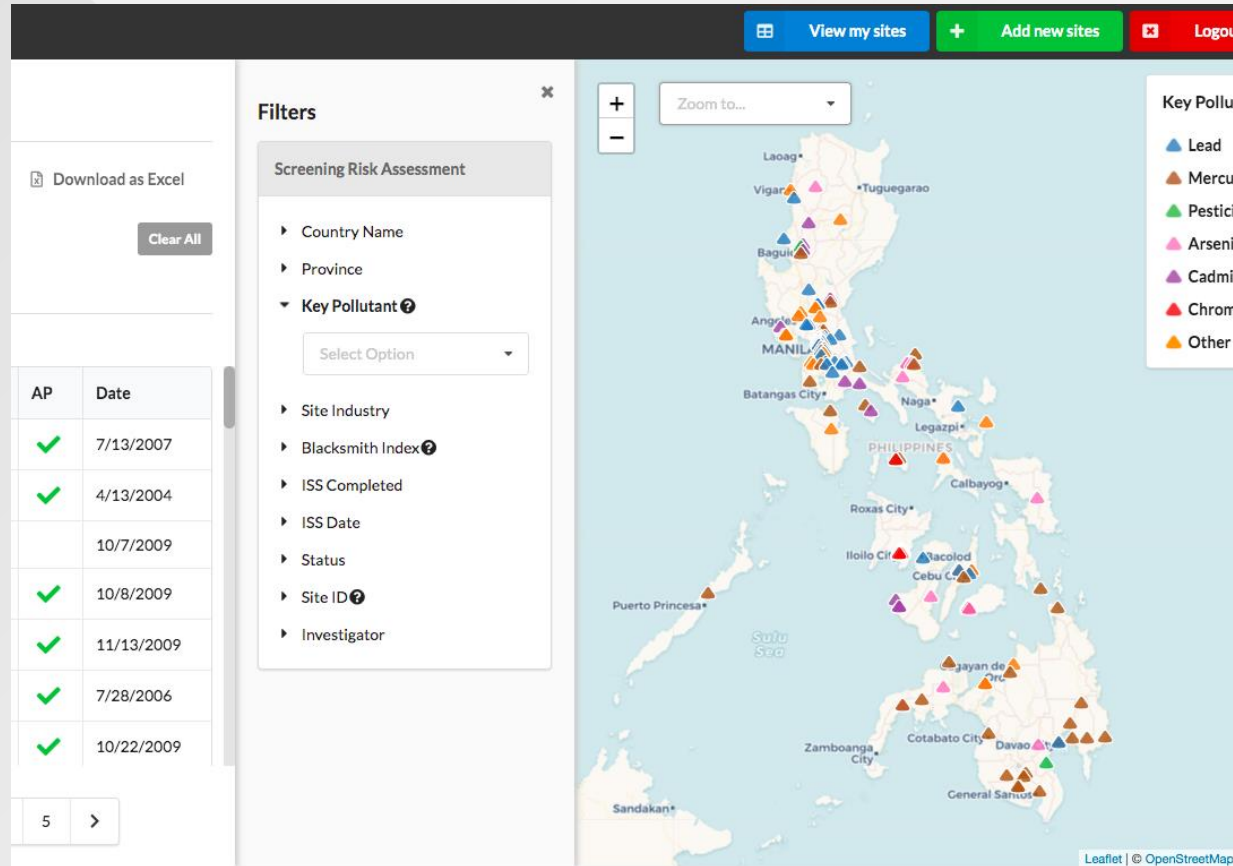


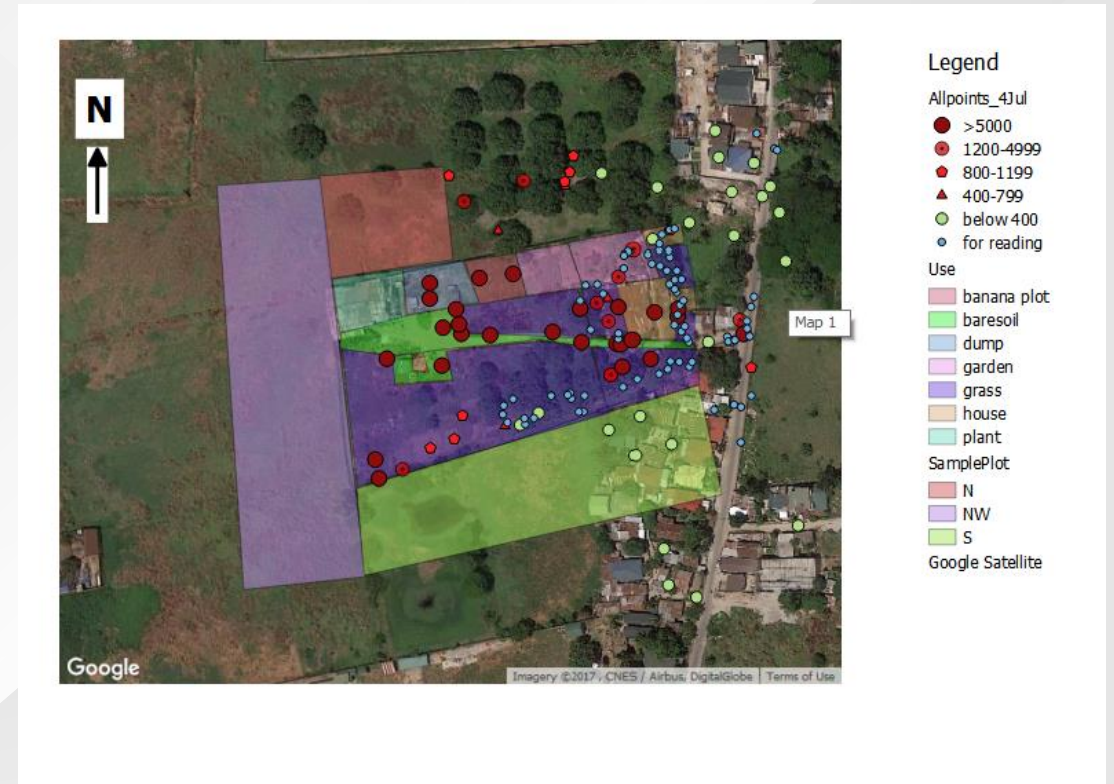
Figure 2. Key polluting industries in the GIP sites assessed in the Philippines

Toxic Sites Identification Program (TSIP)

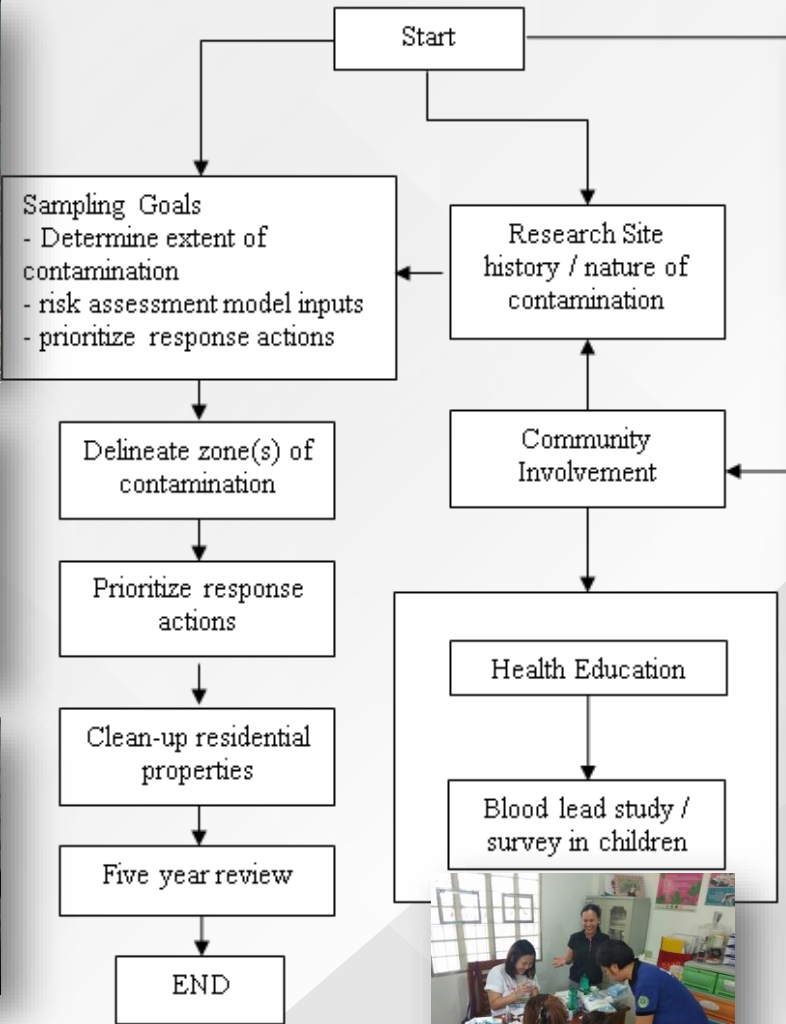


TSIP Methods in the Philippines

- **Targeted Site Assessment**
 - from “point source” (a fixed location, not air pollution from cars and trucks),
 - with concentrations that can cause adverse human health impacts,
 - with clear migration route and exposure pathway to humans;
 - initial site assessment (ISA),
detailed site assessment (DSA)



Community Exposure Mitigation

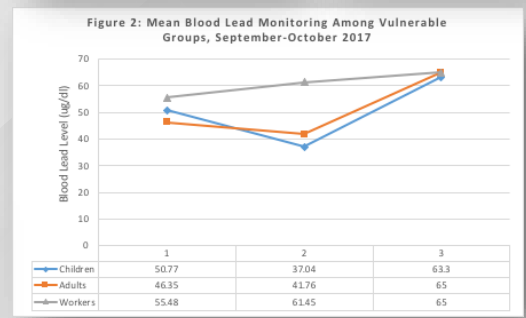


LEAD FACT SHEET
Pagkalasan sa Tingga ay Iwasan!

Ano ang Tingga? Paano napatunay ang Tingga sa katawan ng tao?

Isang maaring magandang o matagpuan ang Tingga?

Kokit masama ang Tingga sa kaluwagang lalo sa mga bata?



KAPAKANAN NG INYONG ANAK AY MAPAG-IINGATAN KUNG TINGGA AY IIWASAN!

Maging mapagmahal sa mga lehitimang pagkalasan sa tingga. Hindi dito ay ang imong sumusunod:

Pagbawas ng antas ng lehitimang pagkalasan sa tingga.

Problema sa pagkita ng kawalan ng focus.

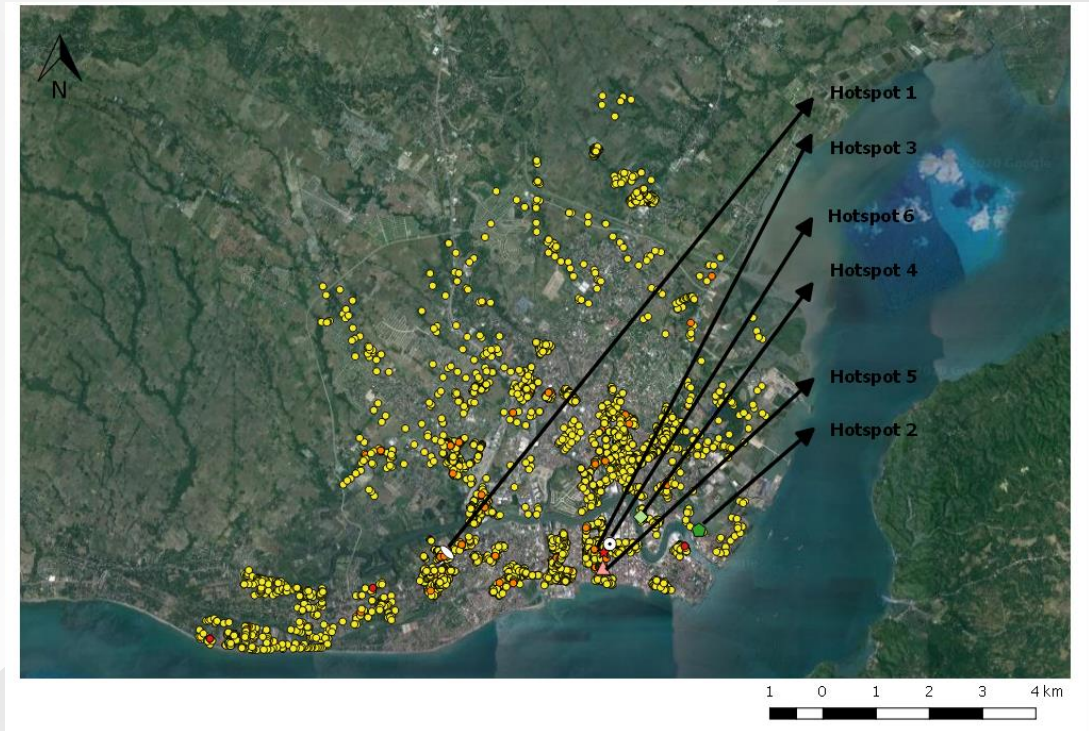
Problema sa pagkita ng pagkatala.

Matagal na pagkita ng pananalitik.

Agad na sumunod sa iyong barangay o local health center. Kapag nakatapos ang mga sintomas, mag-ingat sa iyong anak.

TSIP Methods in the Philippines

- **Investigative Site Assessment**
 - more extensive and random (e.g., unbiased) sampling approach
 - to evaluate heavy metals concentrations across the cities
 - in an effort to understand the geographic distribution of selected heavy metals in surficial soil and
 - to potentially identify sites for more targeted investigations.



Data on Lead Exposure Sources

Parameters	Previously	Recently
Lead releasing industries	Mining, smelting and used lead acid battery (ULAB) handling and recycling industries, waste dumps, junkshops, radiator shops, etc.	No recent assessment - data may be available for registered industries - data limited or lacking for unregistered industries
Lead handling establishments	282 nationwide	
Lead contaminated sites	50 with lead as main pollutant	No recent assessment - who will carry out the responsibility to do so?
X-ray Fluorescence (XRF) reading	56,945.06 ppm on the average	

*US EPA – 200 ppm for residential/play areas, 1200 for industrial/non-play areas

Make a Stronger Case for Lead

NEGATIVE HEALTH IMPACTS OF LEAD POISONING

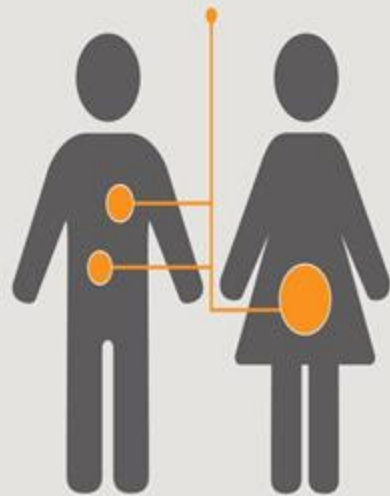
CHILDREN

Decreased intelligence
Behavioral difficulties
Learning problems



ADULTS

Cardiovascular disease
Liver/kidney disease
Pregnancy complications



90% of children with high lead levels are in low- and middle-income countries.

800 MILLION CHILDREN

Lead in cookware and spices.

Informal recycling of car batteries



Lancet Planetary Health paper published in 2023

Children under five lost 765 million IQ points - 80% greater

5.5 million adults died from CVD due to lead exposure - 6x greater than the 2019 estimate

Global financial cost of lead exposure was US\$6 trillion, more than 10% of GDP of LMICs

Policies and Standards in Place

ITEM/MEDIUM	STANDARD	SOURCE/REFERENCE
Consumer Products		
Food	0.01 – 0.05 ppm	Philippine National Standard, Bureau of Agriculture and Fisheries Standards 194:2017
Drinking Water	0.01 ppm	Philippine National Drinking Water Standards, 2017
Cosmetics	20 ppm	Department of Health, Bureau of Food and Drugs, Bureau Circular 2006-012
Children’s Articles (Toys, School Supplies), Paint, Packaging Materials, Fuel Additives, Pipes	90 ppm	DAO 2013-24: Chemical Control Order for Lead and Lead Compounds
Environment		
Water	0.01 – 0.1 mg/L	DAO-2016-08: Water Quality Guidelines and General Effluent Standards
Air	1 – 1.5 ug/NCM	National Ambient Air Quality Guideline Values (NAAQGV) based on the Clean Air Act
Soil	200 ppm play areas, 1200 non-play areas	EPA
Blood	3.5 – 5 ug/dL	US CDC/WHO

Previous Studies on Consumer Products



Rapid Market Screening (RMS)

Obtaining representative consumer goods samples available to the public and testing them for lead levels



Rapid Market Screening
Sampling Protocol

PURE EARTH
March 2023

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Home-based Assessments (HBA)

Investigating potential sources of exposure within and around the home, analyzing both environmental and consumer goods for lead levels



X-ray Fluorescence (XRF)
Analyzer



Recent Data on Lead Exposure Sources

Products/Items	Global Rapid Market Screening (RMS) - 5000 samples, 25 countries	Local Rapid Market Screening (RMS) – 256 samples, LuzViMin	Home-based Assessments (HBA) – 21 homes, Metro Manila
Metal cookware	51% 119,500 ppm	24% 1,470 ppm	48% 3,700 ppm
Ceramic food ware	45% 397,100 ppm	13% 1,159 ppm	25% 205,000 ppm
Household paints	41% exceedance 807,309 ppm	16% 41,800 ppm	44% 13,400 ppm

*Chemical Control Order for Lead – 90 ppm

LEAD ENVIRONMENTAL INSPECTION PROCESS



Key Considerations

1. Protocol – viable how to

- ISA/scoping process
- Portable equipment
- Template forms
- Train tech/non-tech local personnel
- Applicable or adaptable to local contexts

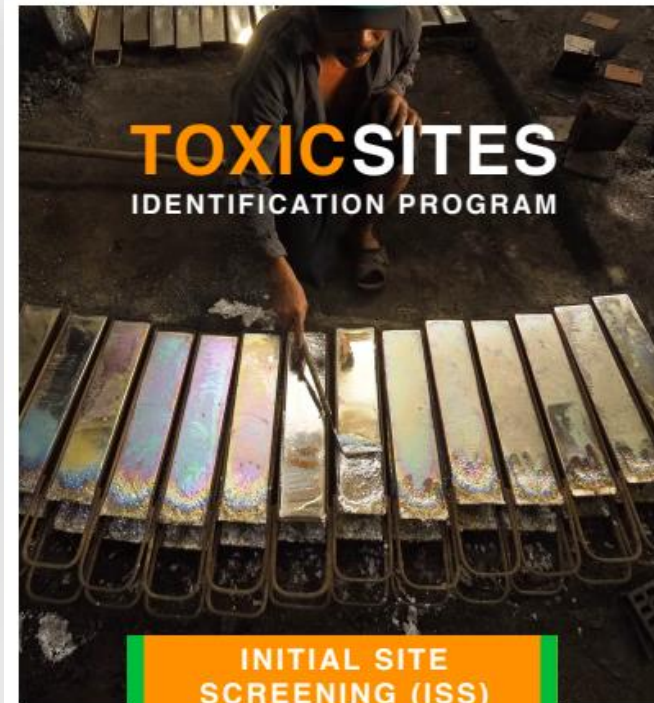


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AFTER YOUR SITE SCREENING.....
FREQUENTLY ASKED QUESTIONS

New Protocols – Source Specific



Metal Cookware Leaching Test

Protocol Document



October 2024



Protocol for Testing Metal Cookware for Lead and Other Toxic Metals



October 2024

<https://www.pureearth.org/protocols-and-technical-guidelines/>

2. Partners – we can't stand alone

- Investigators
- Government
- Academe
- Industry, Professionals
- Civil Society Organizations
- Local Champions,
Community Members



3. Preparation – appropriate messaging

- Government – Here to help
- Industry – Help not halt
- Community
 - Assured feedback
 - Intervention if possible
 - Clear expectations
 - Care as motivation



3. Intervention – everyone contributes

- Mitigation or remediation – Stop the Source
- Pre- and post-BLL screening – Show Effectiveness
- Government – Sustain by Institutionalizing Interventions
 - Policy development/amendment
 - Programming with fund allocation
- Industry – Process Improvement
- Academe/Professionals – Capacity Building
- Community – Raise Awareness/Advocates, Create Linkages

4. Other Key Considerations

- Pilot or proof of concept
- Pro-active, and preventive in cases like ours
- People of skill and principle

Drive Action on All Fronts, The Children Deserve Lead-Free Futures



Poisoning Sources

Comprehensive Source Assessment
and Alternatives, Compliance to
Lead-Free Standards



Poisoning Migration / Pathways

Awareness Raising, Capacity Building
especially among environment and
health front liners; general public on
Mitigation Measures



Population at Risk

BLL Screening,
“Early Detection, Early Intervention”

Thank you

Larah Ortega – Ibañez

Country Director, Pure Earth Philippines

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www.pureearth.org

Zamfara, Nigeria Lead Poisoning Response

Simba Tirima, PhD, Country Representative for Nigeria, Médecins Sans Frontières
Casey Bartrem, PhD, Executive Director, TerraGraphics International Foundation



Outbreak discovery and initial investigations

Search Area 2012

Blood Lead Levels

Emergency Response

Map of Zamfara State showing the search area and blood lead levels. Includes text about emergency response and a small image of a person.

Assessing Exposure and Risk

Images showing children and hands, illustrating exposure assessment and risk factors.

Environmental Health Intervention Interdisciplinary Response

ENVIRONMENT AND ENVIRONMENTAL HEALTH INTERVENTION

MSP provides medical treatment (heavy metal chelation or "saucou")

TIFO provides government on implementing environmental remediation

Images showing medical treatment and environmental remediation efforts.

Remedial Effectiveness Evaluations

Graphs and charts showing remedial effectiveness evaluations, including data on BLLs and treatment outcomes.

- 4 REEs in Zamfara
- 2008 REE most extensive (5 year residency)
- Other biased towards homes with BLLs not responding to chelation treatment

Outbreak discovery and initial investigations

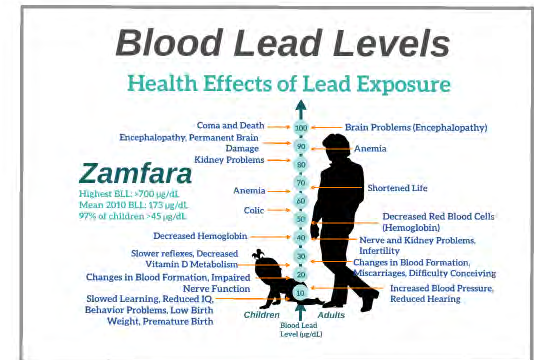


Anka and Bukkuyum Local Government Areas

- Remote, rural locations
- Villages without cell signal, electricity
- Many roads impassible during rainy season
- Impacted villages 1-4 hours from nearest town with basic infrastructure

March-May 2010

- Rural health workers began seeing strange, severe symptoms in young children (<5 years)
- Doctors Without Borders (MSF) outbreak surveillance teams contacted
- MSF investigated
- Children did not respond to treatment for malaria, meningitis, etc.
- Local leaders suspected relationship between artisanal mining and outbreak
- MSF sent blood samples to Europe for analysis
- Exceptionally high blood lead levels (BLLs) reported
- State authorities, US CDC, WHO, TIFO engaged in investigation



Unprecedented Outbreak

Outbreak discovered in **March 2010** by MSF

400 children died in first **6 months**

25% mortality rate in children <5 years

8 villages in Zamfara State

2 villages in Niger State

Total population affected **>18,000**

Initial Investigation



March-May 2010

- Rural health workers began seeing strange, severe symptoms in young children (<5 years)
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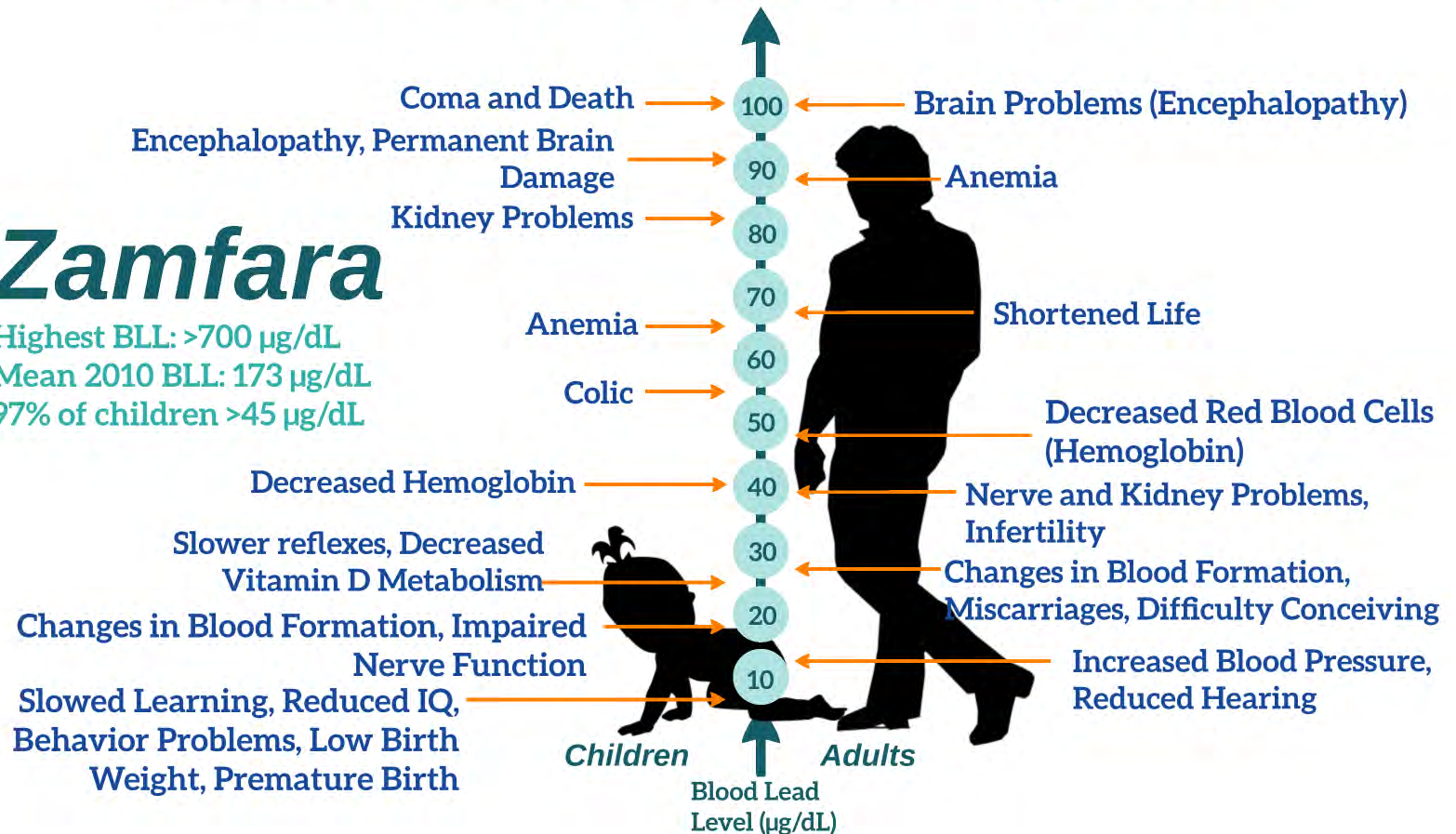


Blood Lead Levels

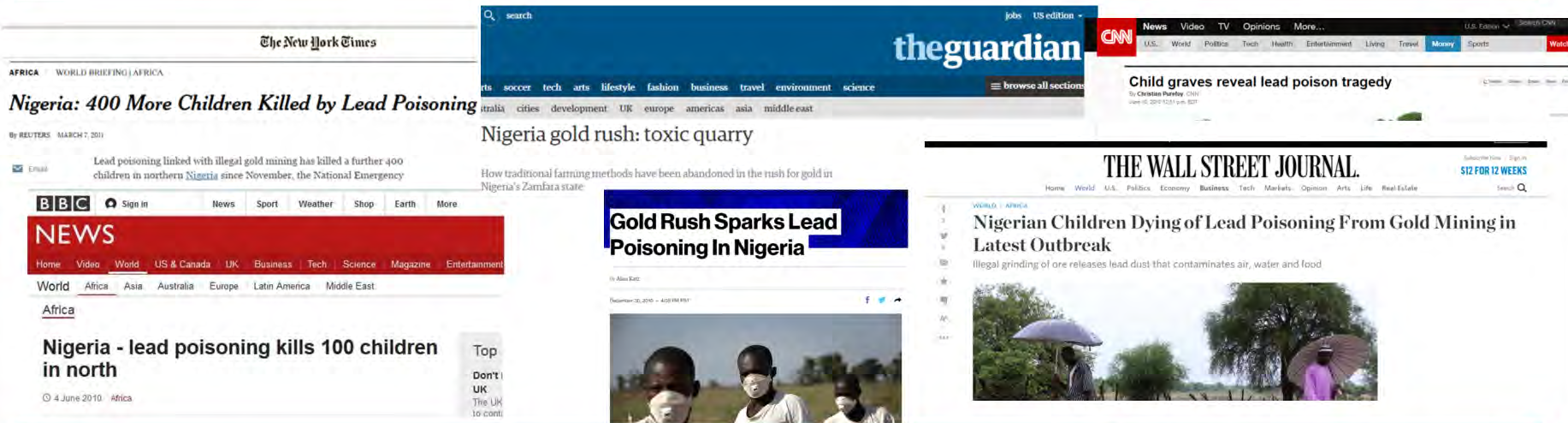
Health Effects of Lead Exposure

Zamfara

Highest BLL: >700 µg/dL
Mean 2010 BLL: 173 µg/dL
97% of children >45 µg/dL



Unprecedented Outbreak



Outbreak discovered in **March 2010** by MSF



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25% mortality rate in children <5 years

Total population affected **>18,000**

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Zamfara, Nigeria Lead Poisoning Response

Simba Tirima, PhD, Country Representative for Nigeria, Médecins Sans Frontières
Casey Bartrem, PhD, Executive Director, TerraGraphics International Foundation



Outbreak discovery and initial investigations

Search Area 2012

Blood Lead Levels

Emergency Response

Map of Zamfara State showing the search area and lead poisoning cases.

Assessing Exposure and Risk

Photos of children and adults in the affected area.

Diagrams illustrating exposure pathways and risk assessment.

Environmental Health Intervention Interdisciplinary Response

HEALTH AND ENVIRONMENTAL ACTION NETWORK

MSP provides medical treatment (heavy metal chelation or "saucou")

TIFO (TerraGraphics International Foundation) advises government on implementing environmental remediation

Photos of medical treatment and environmental remediation activities.

Remedial Effectiveness Evaluations

Graphs showing lead levels and remediation effectiveness.

- 4 REEs in Zamfara
- 2012 REE most extensive (5 year history)
- Other based towards homes with BLLs not responding to chelation treatment

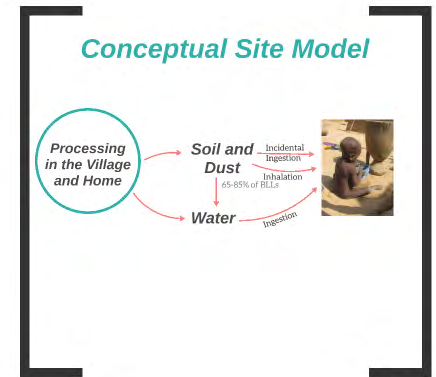
Assessing Exposure and Risk



Environmental Sampling

1. Interview
2. Draw the site
3. Test using XRF
 - Gridded sampling
 - Judgmental sampling
4. Assess contamination depth
5. Report results to household

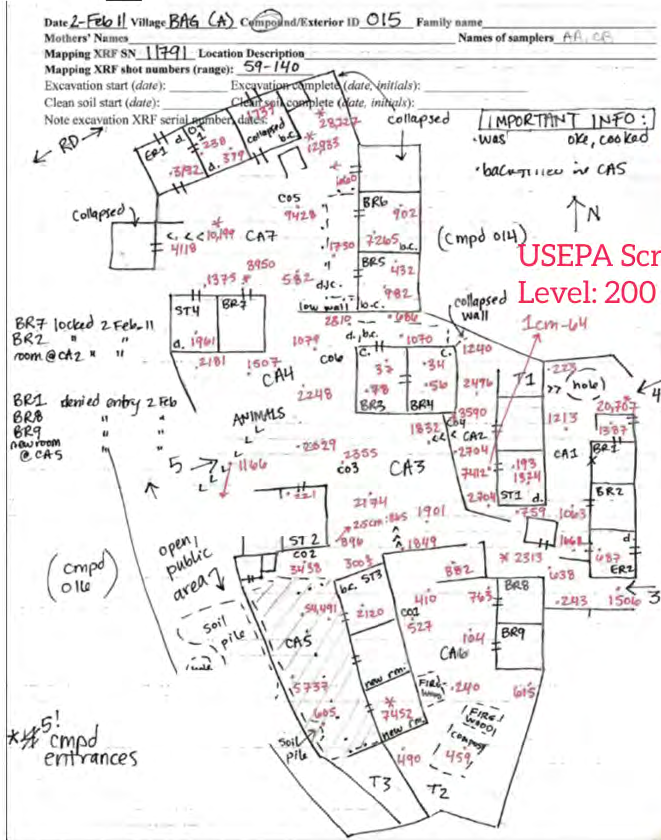
USEPA Screening Level: 200 mg/kg



Dietary Exposures in Zamfara

Estimated dietary contribution to BLL: 11-34% of children's BLLs

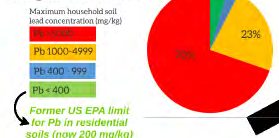
Environmental Sampling



1. Interview
2. Draw the site
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 - Gridded sampling
 - Judgmental sampling
4. Assess contamination depth
5. Report results to household



Yargalma homes, 2010



Note excavation XRF serial numbers, dates:

← RD →

IMPORTANT INFO:
• WAS Oke, cooked
• back-tiled in CAS



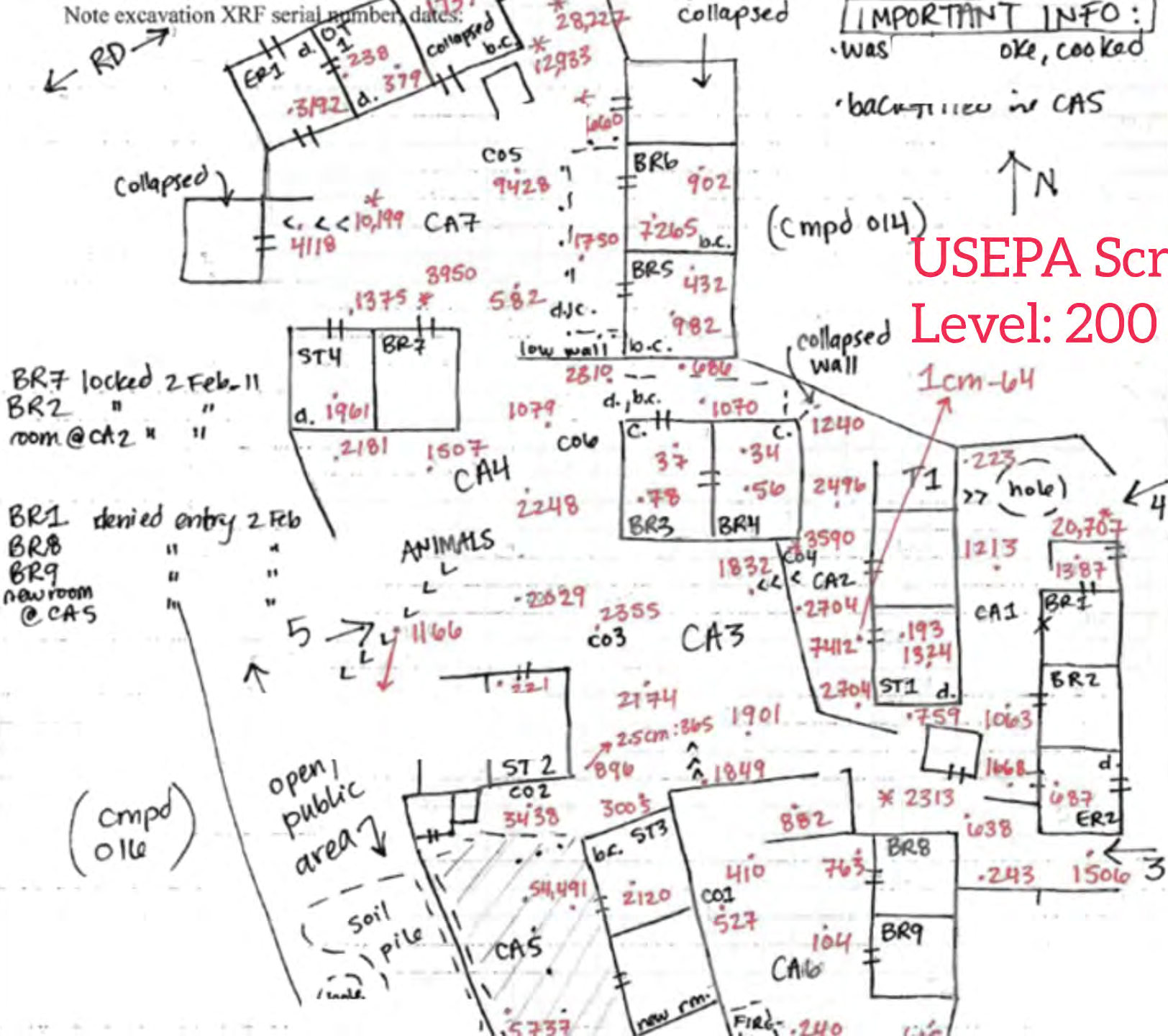
3

Collapsed
BR7 locked 2 Feb-11
BR2 " " " " " "
room @ CA2 " " " " " "

BR1 denied entry 2 Feb
BR8 " " " " " "
BR9 new room @ CAS

(Cmpd 016)

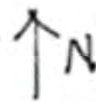
open public area
Soil pile



USEPA Screening Level: 200 mg/kg

4

5



(Cmpd 014)

1cm-64

hole

4

3

Fire

Note excavation XRF serial numbers, dates:

← RD →

IMPORTANT INFO:
- WAS Oke, cooked
- back-tissue in CAS



3

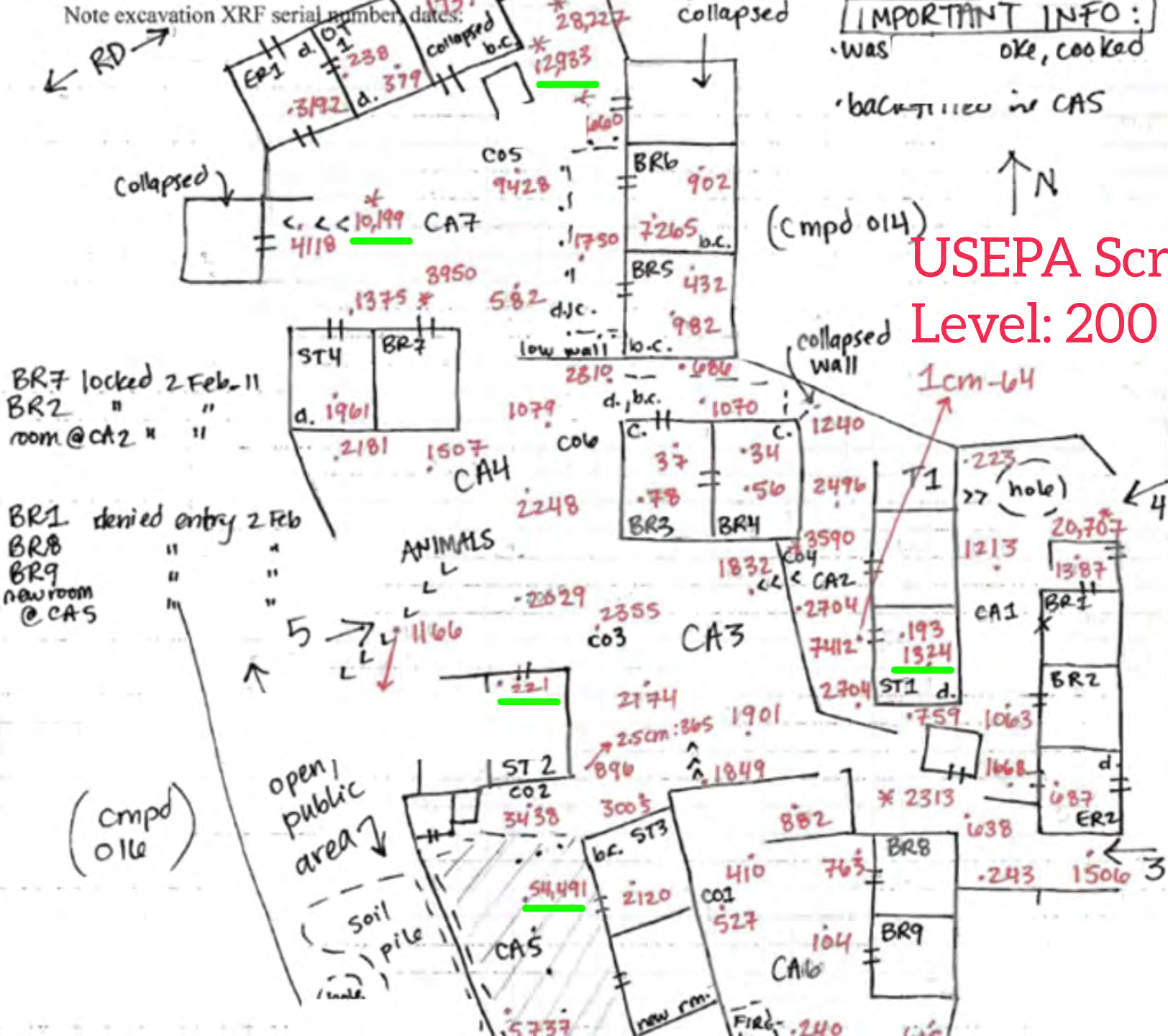
Collapsed
C. < < 10,199
4118
CA7

BR7 locked 2 Feb-11
BR2 " " " " " "
room @ CA2 " " " " " "

BR1 denied entry 2 Feb
BR8 " " " " " "
BR9 " " " " " "
new room @ CAS

(Cmpd 016)

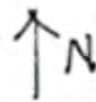
open public area
Soil Pile



USEPA Screening Level: 200 mg/kg

4

5



(Cmpd 014)

← 4

← 3

Fire

Yargalma homes, 2010

Maximum household soil
lead concentration (mg/kg)

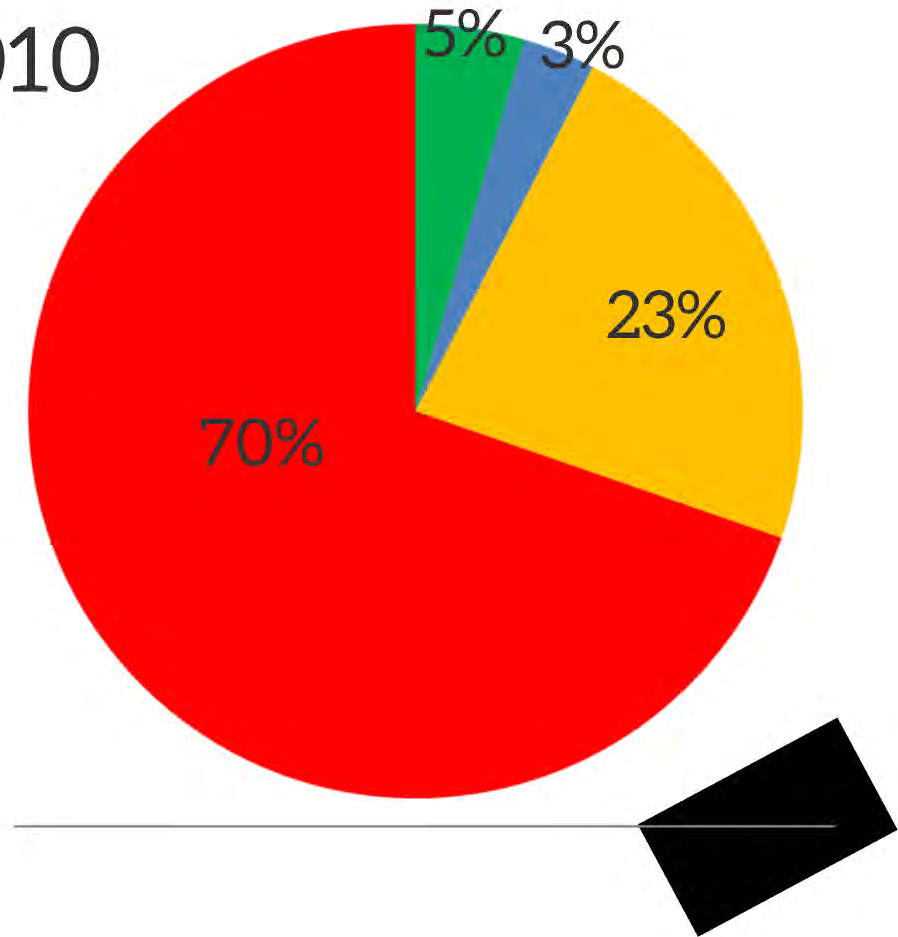
Pb >5000

Pb 1000-4999

Pb 400 - 999

Pb < 400

*Former US EPA limit
for Pb in residential
soils (now 200 mg/kg)*



Gold Mining and Processing



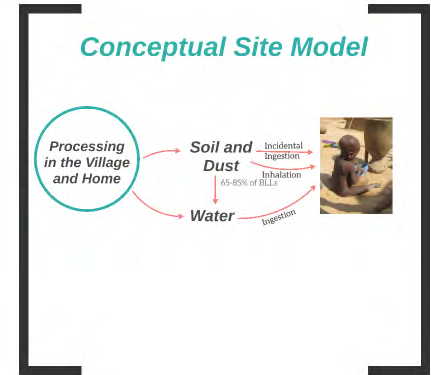
Assessing Exposure and Risk



Environmental Sampling

1. Interview
2. Draw the site
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USEPA Screening Level: 200 mg/kg



Dietary Exposures in Zamfara

Estimated dietary contribution to BLL: 11-34% of children's BLLs

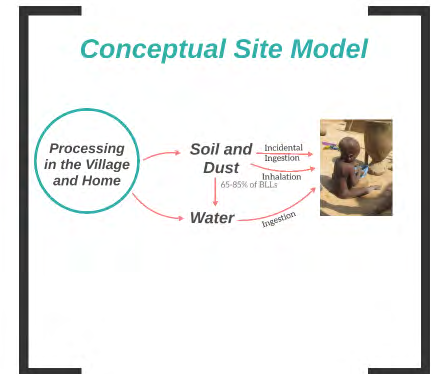
Assessing Exposure and Risk



Environmental Sampling

1. Interview
2. Draw the site
3. Test using XRF
 - Gridded sampling
 - Judgmental sampling
4. Assess contamination depth
5. Report results to household

USEPA Screening Level: 2000 mg/kg



Dietary Exposures in Zamfara

Estimated dietary contribution to BLL: 11-34% of children's BLLs

Dietary Exposures in Zamfara

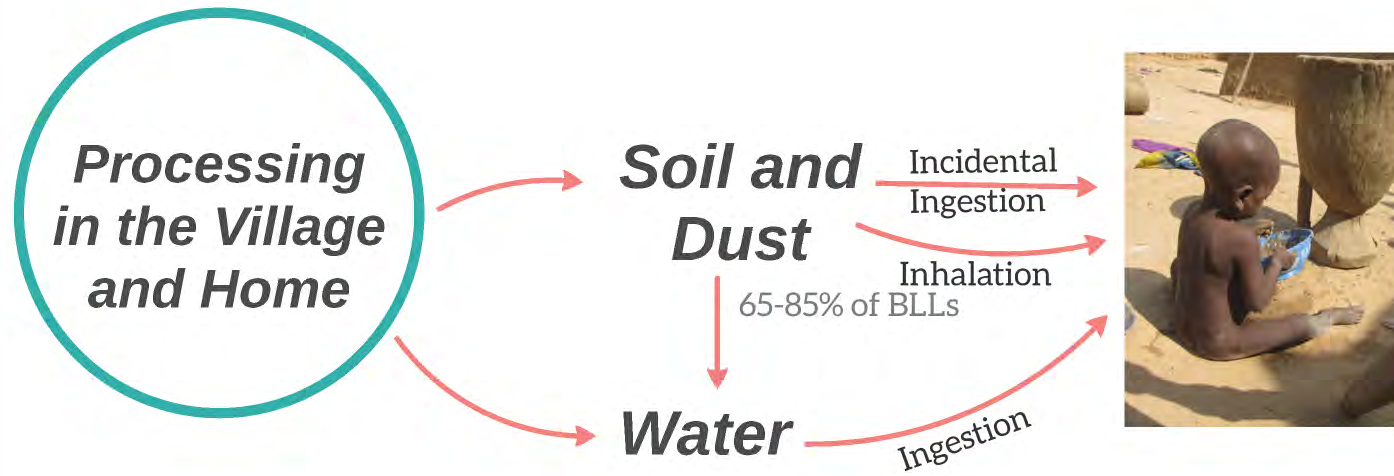


Food type	source	Notes	harvested, stored	processed (ready to cook or eat)	dried vegetables, herbs, and spices	traditional medicines and herbs	mean (sd)
guinea corn (sorghum)	Baggea village	whole grain	0.93				0.86 (0.77)
	Baggea farm	whole grain	0.41				
	Ajika market	whole grain	-0.05				
millet	Baggea village	dried, milled		2.06			0.41 (0.27)
	Baggea farm	whole grain	<0.05				
maize (corn)	Baggea village	grown, ready to cook		0.66			0.20 (0.08)
	Baggea farm	whole grain, dried sorghels	0.27				
local rice	Ajika market	whole grain, dried sorghels	0.32				0.30 (0.26)
	Baggea market	whole grain	0.73				
white rice	Baggea farm	Hulled	<0.05				0.52 (0.29)
	Ajika market	whole grain, with hulls	0.2				
bread (white)	Baggea farm	whole grain, with hulls	0.44				0.52 (0.29)
	Ajika market	whole grain	0.09				
wheat flour	Baggea bakery	dried 3 days, pulverized		0.31			0.52
	Baggea bakery	dried 3 days, pulverized		0.32			
cowpee	Guusu market	uffed wheat flour		0.32			0.27 (0.12)
	Baggea village	Whole	0.34				
tapiro bean	Baggea farm	Whole	0.39				1.93 (1.49)
	Ajika market	Whole	0.36				
pawpaw	Baggea market	Whole	0.981				0.51 (0.41)
	Baggea village	boiled, pounded, dried, ready to eat		0.45			
bobab leaves	Ajika market	boiled, pounded, dried, ready to eat		0.44			1.46
	Baggea market	pounded, ready to eat		0.92			
tomatoes	Baggea market	dried, ready to cook					0.3
	Ajika market	dried, ready to cook					
grape root	Baggea market	dried, ready to cook					2.86
	Ajika market	dried, pulverized, ready to cook					
chiles	Baggea market	dried, ready to cook					0.62
	Ajika market	dried, ready to cook					
tamarind	Baggea market	pod, ready to cook/eat					0.18
	Ajika market	pod, ready to cook/eat					
medicine	Baggea market	local medicine				0.69	1.40 (0.93)
	Ajika market	local medicine				2.22	
overall mean (sd)			0.32 (0.29)	0.85 (0.64)	24.91 (64.10)	0.14 (0.93)	0.66 (0.77)

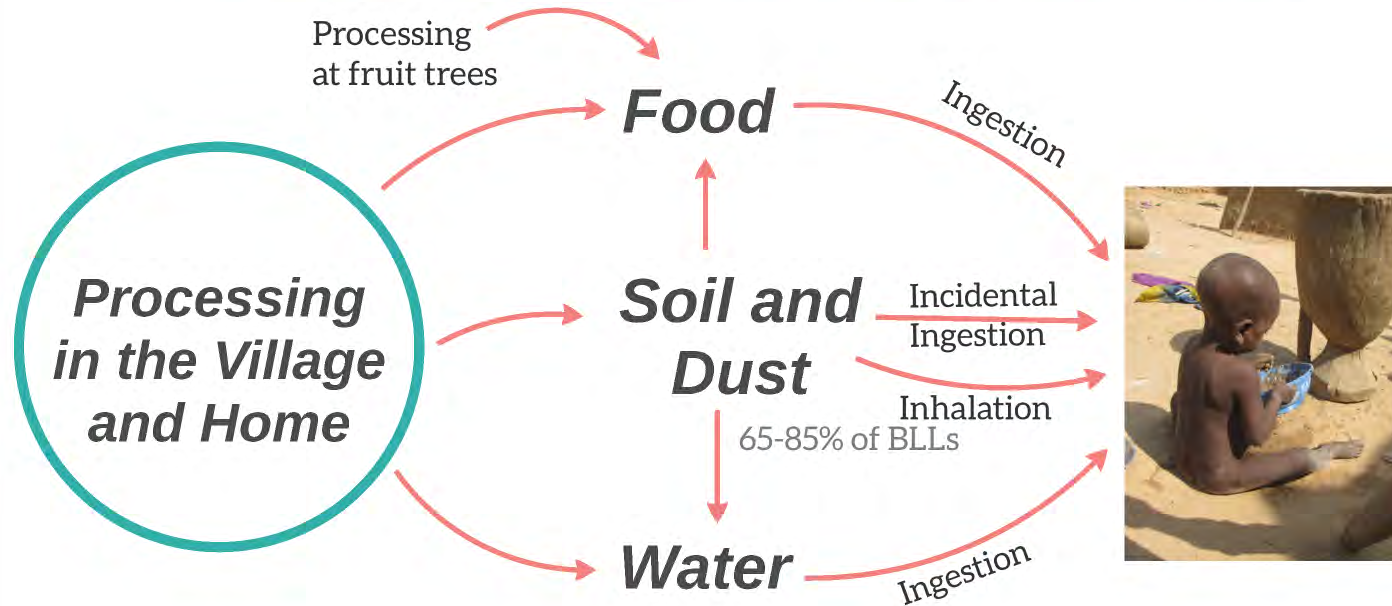
Table S2. Matrix of lead contamination levels ($\mu\text{g}/\text{g}$) in local foodstuff (ICP-AES results - dry weight) by food type and processing stage. Cells in gray were not included in dietary Pb intake analyses.

Estimated dietary contribution to BLL: 11-34% of children's BLLs

Conceptual Site Model



Conceptual Site Model

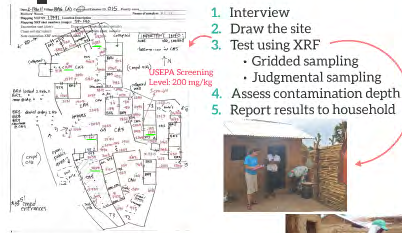


Assessing Exposure and Risk



Kids eat dirt.

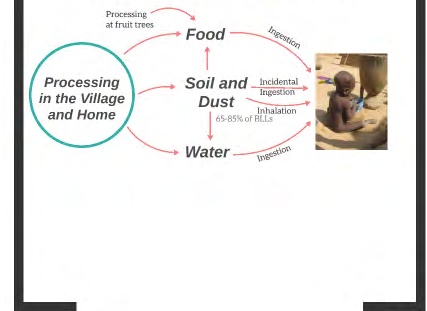
Environmental Sampling



Gold Mining and Processing



Conceptual Site Model



Dietary Exposures in Zamfara



Estimated dietary contribution to BLL: 11-34% of children's BLLs

Environmental Health Intervention

Interdisciplinary Response



MEDECINS SANS FRONTIERES
DOCTORS WITHOUT BORDERS

MSF provides medical treatment (heavy metal chelation or "succimer")



<http://www.doctorswithoutborders.org/>



<http://www.doctorswithoutborders.org/>



TERRAGRAPHICS INTERNATIONAL FOUNDATION
Working with Communities to Mitigate Environmental Pollution

TIFO advises government on implementing environmental remediation

Objectives of Remediation

- Implement emergency environmental remediation to abate exposures;
- Facilitate chelation treatment of children 5 years old;
- Establish local capacity to prevent future disasters



Environmental Remediation

- Modification of US (Superfund) hazardous waste removal protocols to local resources and culture
- Progressing from an emergency response to comprehensive cleanup funded and accomplished by the Nigerian government.

Excavation



Clean Soil



Health Messaging



Results (Zamfara)

Village	Phase	Compounds Tested	Compounds Remediated	Exposure Remediated	Ponds Remediated	Pre-rem. Mean Pb Conc. (mg/kg)	Post-rem. Mean Pb Conc. (mg/kg)	Exposure Reduction
Dawula	I	94	85	12	4	3582	53	98%
Yezigala	I	66	63	11	2	4143	179	96%
Alfari	II	96	74	20	0	1347	91	93%
Tungu-Daru	II	88	26	6	1	4754	83	98%
Sandu	II	53	83	38	10	1119	106	91%
Tungu-Daru II	II	78	72	37	10	790	72	91%
Dudu	II	37	27	8	2	300	70	77%
Birgashi	III	403	392	54	3	6250	69	89%
Total		944	820	183	31	3151	94	98%

Table 2.1. Pre- and post-remediation lead (Pb) concentrations and range of residential compounds, exposure areas, and ponds.



reduction in soil lead concentrations
89%

reduction in blood lead concentrations
88%

Objectives of Remediation

- Implement emergency environmental remediation to abate exposures;
- Facilitate chelation treatment of children ≤ 5 years old;
- Establish local capacity to prevent future disasters



Environmental Remediation

- Modification of US (Superfund) hazardous waste removal protocols to local resources and culture
- Progressing from an emergency response to comprehensive cleanup funded and accomplished by the Nigerian government.

Excavation



Clean Soil



Disposal



Health Messaging



Results (Zamfara)

Village	Phase	Compounds Tested	Compounds Remediated	Exteriors Remediated	Ponds Remediated	Pre-rem. Mean Pb Conc. (mg/kg)	Post-rem. Mean Pb Conc. (mg/kg)	Exposure Reduction
Dareta	I	94	85	13	4	3582	83	98%
Yargalma	I	66	63	11	3	4143	179	96%
Abare	II	96	74	20	0	1343	90	93%
Tungar Guru	II	38	31	6	1	874	83	91%
Sunke	II	93	83	38	10	1119	106	91%
Tungar Daji	II	78	75	31	10	780	72	91%
Duza	II	57	57	8	2	300	70	77%
Bagega	III	423	352	54	1	670	90	87%
Total		944	820	181	31	3111	94	89%

Table 2.1. Pre- and post-remediation soil Pb concentrations and range of residential compounds, common areas, and ponds.

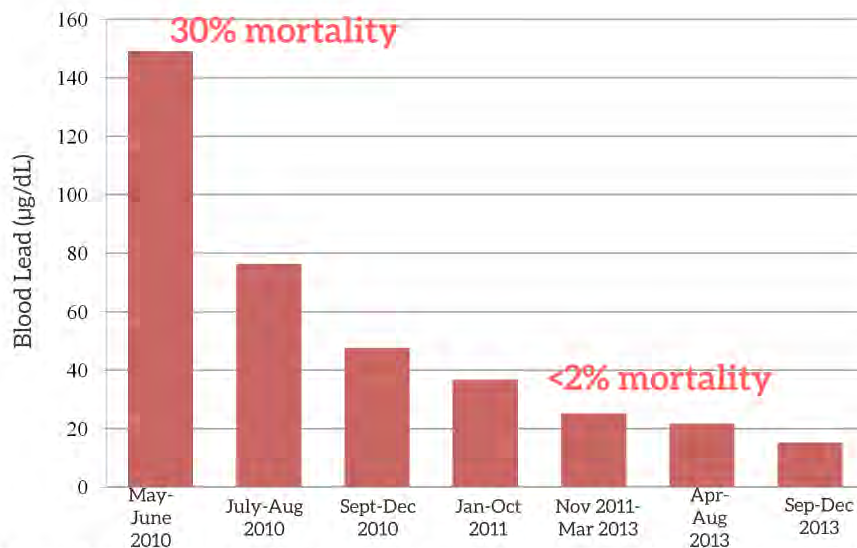


Figure 2.1. Arithmetic mean blood lead levels (µg/dL) for initial draw (prior to chelation) for 0-5-year-old children (MSF 2014).

reduction in
89% soil lead
concentrations

reduction in
88% blood lead
concentrations

Zamfara, Nigeria Lead Poisoning Response

Simba Tirima, PhD, Country Representative for Nigeria, Médecins Sans Frontières
Casey Bartrem, PhD, Executive Director, TerraGraphics International Foundation



Outbreak discovery and initial investigations

Search Area 2011

Blood Lead Levels

Map of Zamfara State showing the search area and initial investigations.

Assessing Exposure and Risk

Kids eat dirt.

Diagrams and photos illustrating lead exposure pathways, including children playing in a contaminated area.

Environmental Health Intervention Interdisciplinary Response

UNEP AND ENVIRONMENTAL ACTION PARTNER AGENCY

MSP provides medical treatment (heavy metal chelation or "saucou")

TIFO

Diagrams and photos showing environmental health interventions and interdisciplinary response.

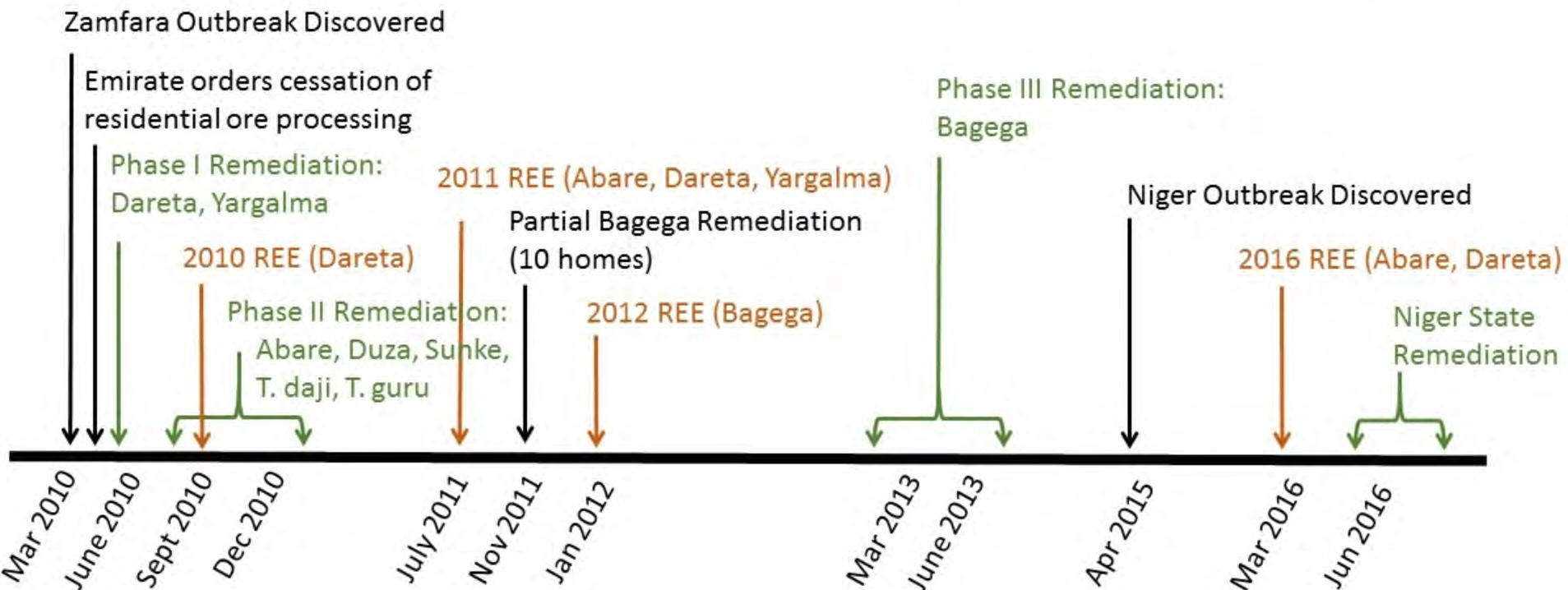
Remedial Effectiveness Evaluations

4 REEs in Zamfara

- 2005 REE most extensive (5 year residency)
- Other based towards homes with BLLs not responding to chelation treatment

Graphs and charts showing remedial effectiveness evaluations.

Remedial Effectiveness Eval



Objectives



1. Assess the efficacy of remediation in reducing BLLs.

Methods

Two subsets of homes tested:

- "Biased" homes with elevated BLLs
- Random homes
- In situ XRF testing

XRF validation

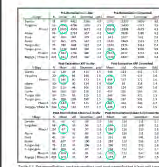
- Collect samples to compare in situ XRF to ex situ sieved ICP-MS results

Interviews

- Child's daily activities
- Where child eats/sleeps/plays
- Places visited during the day
- Observations of child's behavior

Community Discussions

Soil Results



Significant recontamination in villages with increasing BLLs

Abare reached pre-remediation soil lead levels

Dareta had ubiquitous, lower-level recontamination

SIA Res



Objectives



1. Assess the efficacy of remediation in reducing BLLs.
2. Assess the degree of any recontamination.
3. Assess the effectiveness of institutional controls in sustaining the remedy.
4. Assess the capacity of Nigerian governments to prevent and respond to future crises.

Soil Results

Village	N	Pre-Remediation <i>in situ</i>				Pre-Remediation Converted			
		Mean	std	Geomean	gstd	Mean	std	Geomean	Gstd
Dareta	91	3490	4421	1366	4.9	9773	12379	3826	4.9
Yargalma	66	4195	4786	2206	3.5	10601	13400	6177	3.5
Phase I	157	3765	4574	1671	4.3	10541	12808	4679	4.3
Abare	96	1345	2724	457	4.1	3762	7628	1280	4.1
Duza	42	300	367	179	2.8	841	1027	501	2.8
Sunke	82	861	879	547	2.7	2410	2460	1531	2.7
Tungar daji	75	780	848	522	2.4	2183	2374	1461	2.4
Tungar guru	38	1118	2087	486	3.9	3129	5843	1360	3.9
Phase II	333	940	1756	440	3.3	2633	4917	1233	3.3
Bagega / Phase III	423	831	1574	360	3.3	2328	4407	1008	3.3
		Post-Excavation XRF <i>in situ</i>				Post-Excavation XRF Converted			
Village	N	Mean	std	Geomean	gstd	Mean	std	Geomean	Gstd
Dareta	12	120	43	111	1.5	336	121	312	1.5
Yargalma	20	161	64	148	1.6	421	179	414	1.6
Phase I	32	146	60	133	1.6	408	167	372	1.6
Abare	50	116	30	114	1.4	321	85	318	1.4
Duza	26	116	44	106	1.6	323	124	296	1.6
Sunke	68	163	120	130	2.0	457	335	365	2.0
Tungar daji	59	125	59	115	1.5	349	166	321	1.5
Tungar guru	26	209	103	190	1.5	584	287	532	1.5
Phase II	229	143	87	125	1.7	401	244	349	1.7
Bagega / Phase III	266	156	132	127	1.9	438	371	356	1.9
		Post-Remediation Clean Soil <i>in situ</i>				Post-Remediation (Clean Soil) Converted			
Village	N	Mean	std	Geomean	Gstd	Mean	std	Geomean	Gstd
Dareta	91	69	42	58	1.9	165	130	111	2.7
Yargalma	66	84	39	56	1.7	244	119	108	2.2
Phase I	157	67	41	57	1.8	156	126	110	2.5
Abare	96	96	42	86	1.7	367	128	211	2.0
Duza	42	95	33	88	1.5	261	90	241	1.6
Sunke	82	107	37	100	1.5	283	110	253	1.7
Tungar daji	75	112	34	106	1.5	296	101	272	1.6
Tungar guru	38	108	42	97	1.7	284	119	252	1.7
Phase II	333	104	38	95	1.6	275	113	242	1.8
Bagega / Phase III	423	103	33	97	1.4	277	97	257	1.5

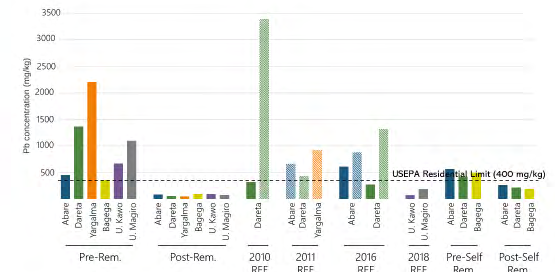
Table 4.5. Pre-remediation, post-excavation, and post-remediation (clean soil cover) statistics for in situ PXRF results and the conversion to analogous ex situ sieved (-80 mesh) ICP-MS results (mg/kg).

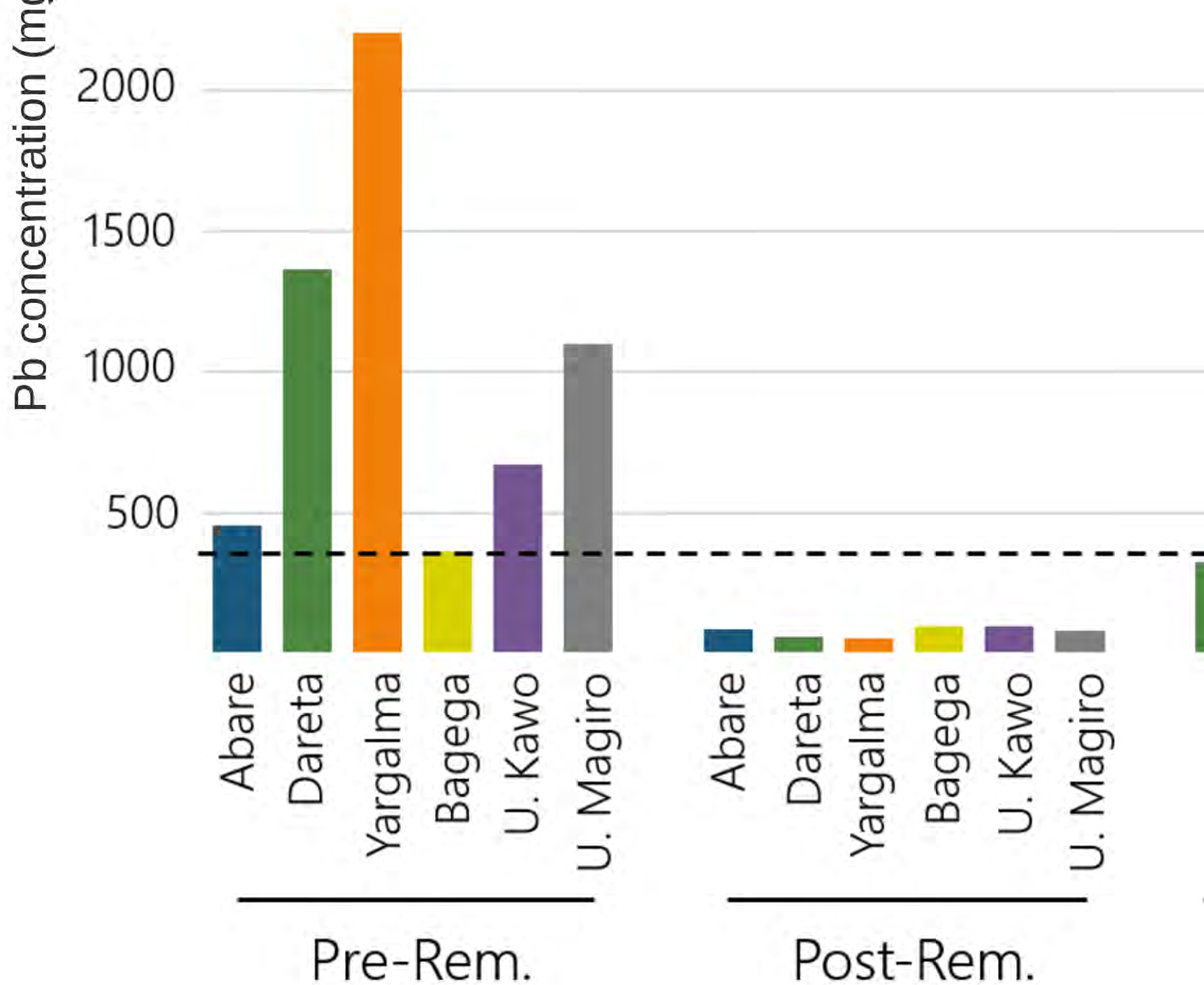


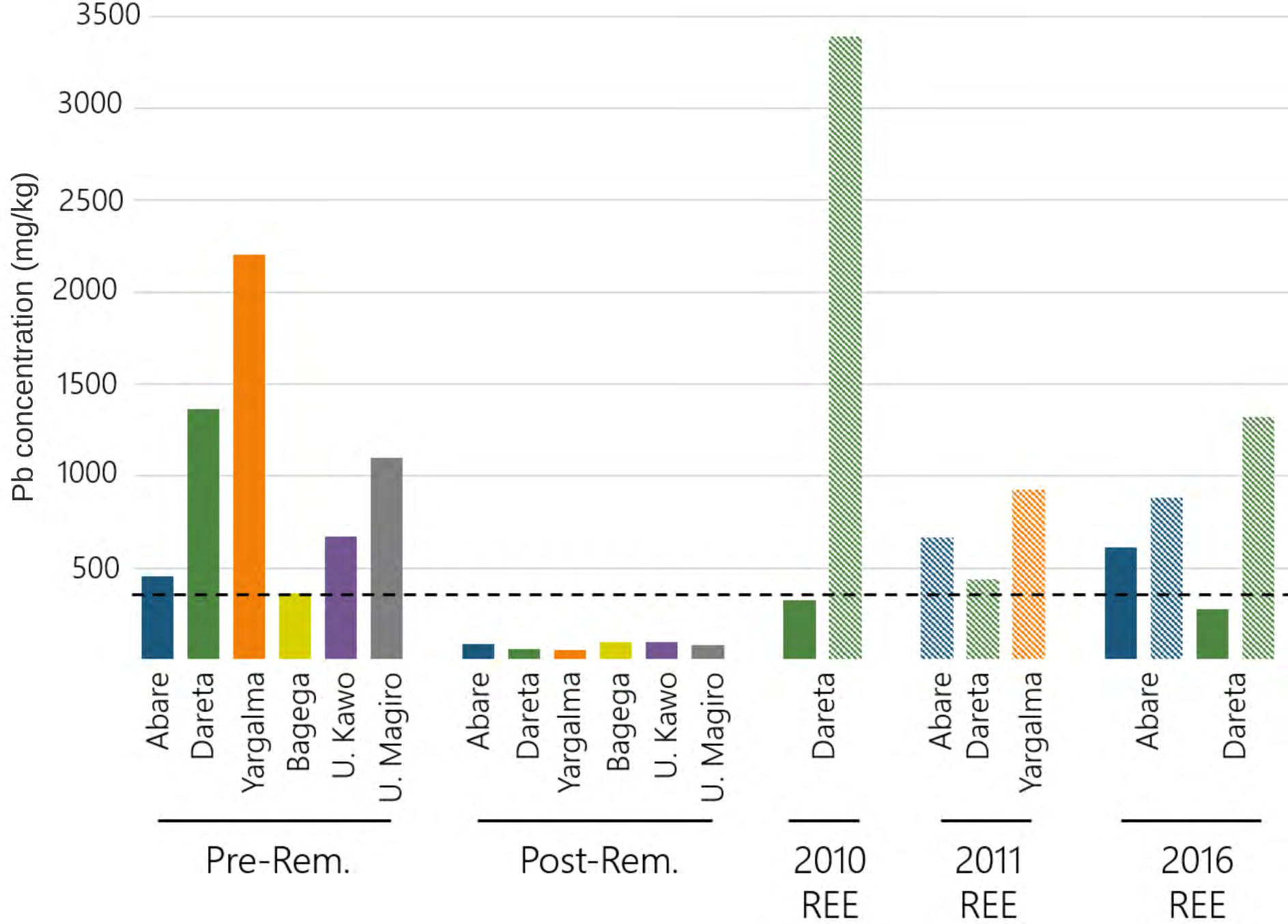
Significant recontamination in villages with increasing BLLs

Abare reached pre-remediation soil lead levels

Dareta had ubiquitous, lower-level recontamination







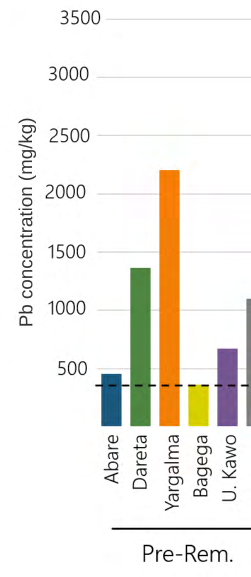


10	2.5
11	2.0
41	1.6
53	1.7
72	1.6
52	1.7
42	1.8
57	1.5

(an soil cover)
 pitu sieved



LOWER



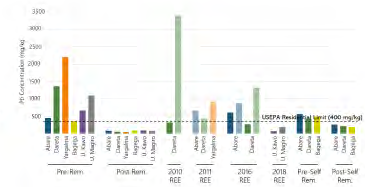
Institutional Controls Program

- Administrative & legal controls to minimize exposures & protect remediation
- Maintained in perpetuity
- Coordinated medical/ environmental/ occupational health/ community effort
- Based on scientific principals/ high-quality data
- Developed and/or adapted locally



ICP in Nigeria

- Health promotion, occupational health & safety training, environmental monitoring, biomonitoring
- Culturally & economically appropriate
- Village councils
- Long-term maintenance includes
 - Self-reporting
 - Institutional surveillance
 - Self-remediation

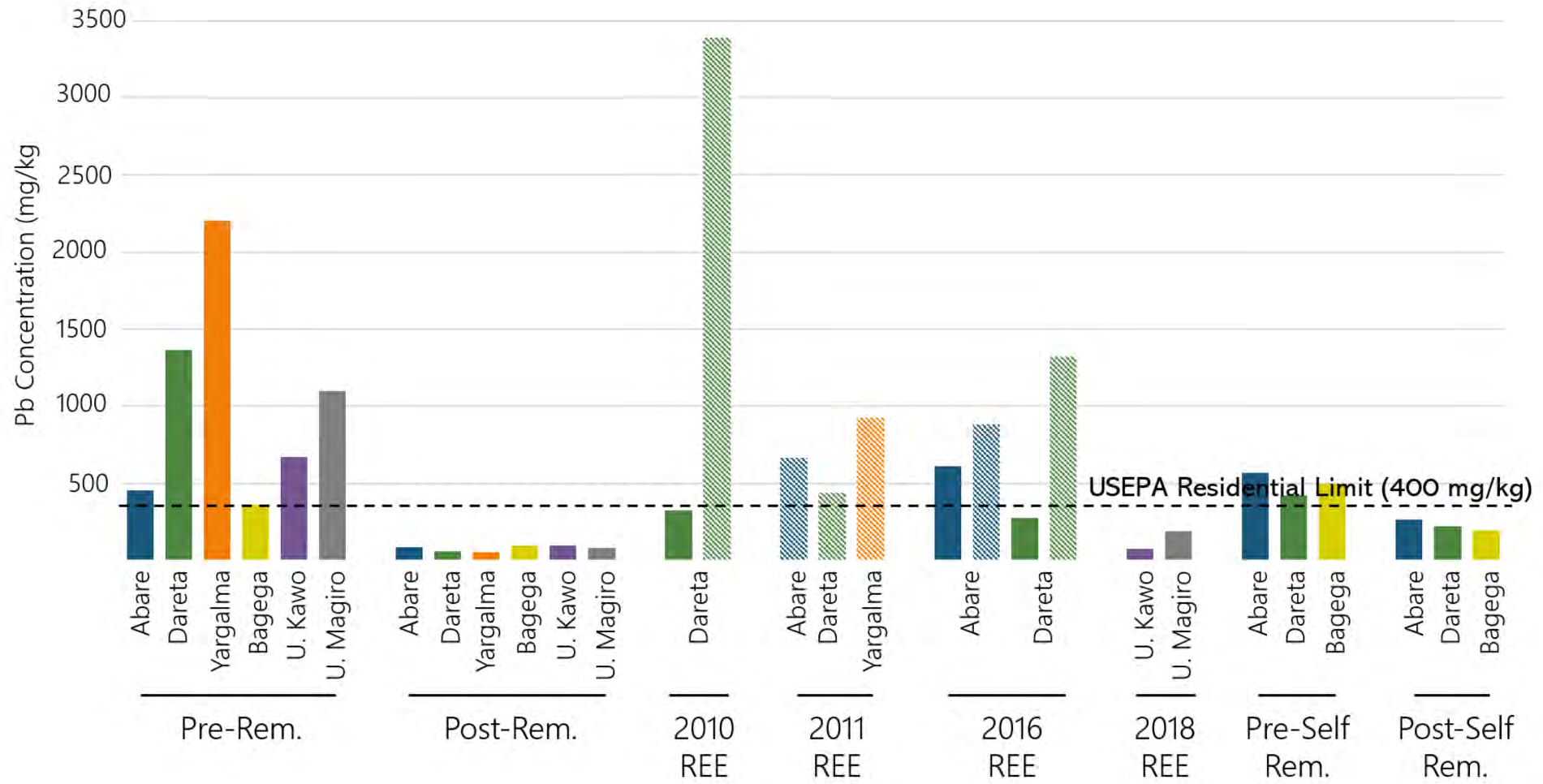




ICP in Nigeria

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Zamfara, Nigeria Lead Poisoning Response

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Outbreak discovery and initial investigations

Map of Zamfara State showing the location of the lead poisoning outbreak. The map highlights the affected areas in the southern part of the state.

Timeline of the outbreak discovery and initial investigations, showing key events from the first case report to the implementation of interventions.

Key findings from the initial investigations, including the identification of lead-contaminated soil and the role of local mining activities.

Assessing Exposure and Risk

Kids eat dirt.

Infographic showing the pathways of lead exposure, from soil to children's hands and mouths, and the resulting health impacts.

Visuals of children playing in a lead-contaminated area, illustrating the high risk of exposure.

Environmental Health Intervention

Interdisciplinary Response

Infographic detailing the collaborative efforts between Médecins Sans Frontières (MSF), TerraGraphics International Foundation (TIFO), and the Nigerian government to address the lead poisoning crisis.

Visuals of community health workers and environmental health workers conducting interventions, such as soil testing and distribution of clean water.

Remedial Effectiveness Evaluations

Infographic showing the results of remedial effectiveness evaluations, including a comparison of lead levels in soil before and after interventions.

Visuals of soil samples and charts showing the reduction in lead levels over time.

- 4 REE in Zamfara
- 2016 REE most extensive (5 year review)
- Often biased towards homes with BLLs only, responding to chelation treatment

Zamfara, Nigeria Lead Poisoning Response

Simba Tirima, PhD, Country Representative for Nigeria, Médecins Sans Frontières
Casey Bartrem, PhD, Executive Director, TerraGraphics International Foundation



1. Engage local and regional leaders from day 0.

Zamfara, Nigeria Lead Poisoning Response

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1. Engage local and regional leaders from day 0.
2. Tackle major sources of exposure, then start investigating and addressing secondary sources.

Zamfara, Nigeria Lead Poisoning Response

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1. Engage local and regional leaders from day 0.
2. Tackle major sources of exposure, then start investigating and addressing secondary sources.
3. Always be working towards development of an intervention that removes the exposure source.