

# Implementing integrated health, response and remediation in diverse economic and cultural settings

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Moscow, Idaho US

International Scientific Symposium on  
Emerging Issues in Environmental and  
Occupational Health: Mining and  
Construction in Transition Economies  
Yerevan, Armenia; April 22-23, 2013

# Traditional Mining and Smelting (Pb)

- United States
  - Bunker Hill - US Superfund examples
  - US leads in recycling but most primary smelters have closed
  - US EPA: “problem solved”
- China - leader in mining, production and use (BATTERIES)

## “New” Sources of Metals and of Exposure are primarily “Old”

- Scavenging at Smelters (Zambia)
- Recycling: E-Waste and Used Batteries (China, Philippines, Senegal, Russia)
- Artisanal Mining (Nigeria)

**Examine response - remediation and  
health**

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# Zambia Copper Smelter



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# Girls selling food at abandoned mine/smelter



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# Women 'mining' zinc in the rubble of Cu smelter & Africa's biggest Pb mine



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Photo: [Nebert Mulenga/IRIN](#)





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# Response = World Bank and Mining Companies to the rescue...

- 2003 World Bank loan to Zambia Consolidated Copper Mines (ZCCM) “Copperbelt Environment Project” = \$15M for Kabwe
  - to protect public health and safety
  - to reduce or prevent damage to the environment
  - to restore mine land and where possible make it available for productive use
  - to promote better environmental practices in the mining
- 2004-06 environ. assessments & rehabilitation plan
- Canal dredging - ordered 2000 people moved without compensation or housing





2004

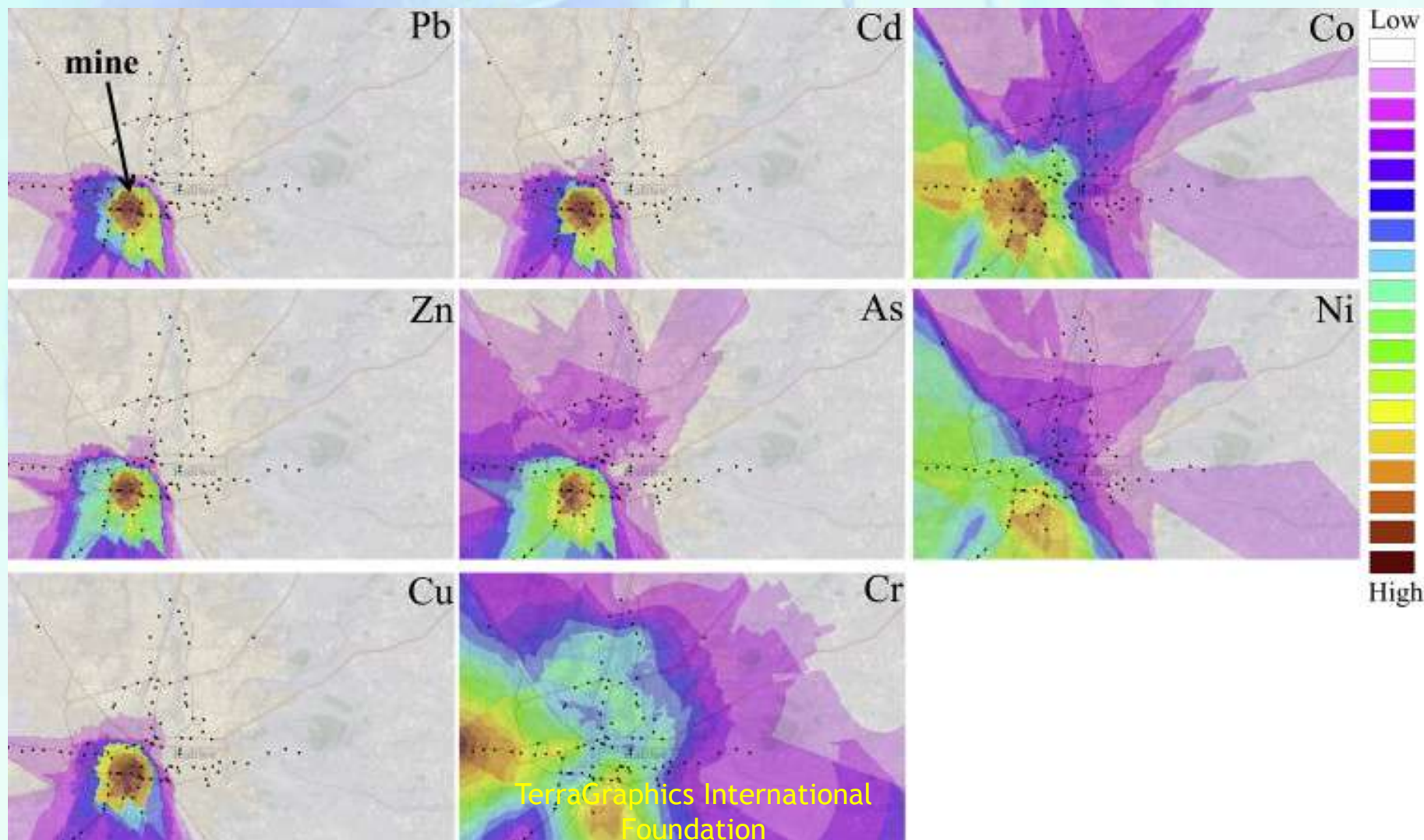


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# Where are the Data?

- Blood lead levels?
- Removal of contaminated soils in residential areas?

# DATA?? “Metal and metalloid contamination in roadside soil and wild rats around a Pb-Zn mine in Kabwe, Zambia”





2012 Response = Berkeley Mineral Resources (BMR) + Chinese Feilong Company bought the stockpiles in response to high metals prices



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Plan to build an “appropriate processing plant to produce metal concentrates...by August 2013”



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“Although BMR is insulated entirely from responsibility for legacy issues...

- ...it intends to fully play its part in remediating and improving the environment in carrying out activities at Kabwe.”
- BMR is “conscious of the need to contribute to the social, economic and cultural life of the Zambian community.”
- “the site would benefit from...good roads, water supply, ample power, local labour and rail connections to overseas markets..”



## Chairman of BMR, Masoud Alikhani

- ...is convinced that as well as providing a return on its investments his company will bring benefits to Zambia. “We are cleaning up the environment, introducing new technologies, creating new employment and not impinging on existing resources.”
- Can the laws in Zambia ensure this?
- Can the community, labor organizations and NGOs organize in a way to ensure this?
- Is financing transparent? What if prices plummet?

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# Mining metals from recycled e-waste: Huaqing Recycling Resources, China



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# Mining e-waste site - informal sector, Tondo, Philippines.



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# Separating computer components Family stripping copper wire in Tondo





# High tide in Binuangan, Philippines; children scavenging



# Mining for lead: Recycling Used Batteries







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# Thiaroye Sur Mer, Senegal 2007





- Decades of using battery lead for fishing weights
- In 2007, dramatic **increases in lead prices** stimulated East Indian traders to purchase the lead oxide sludge
- ~200 local women sifted beach sand out of the sludge. Bags of product lead were stored in homes and infants were exposed. 1-10% Pb in soil
- 18 children died before WHO et al. responded





# Recycling Nuclear Submarine Batteries in Russian Far East

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# Response = Technical, Political, and Economic Solutions

- NGOs, WHO, local governments
- Secondary smelters for batteries
- Basel and other Conventions  
...but US hasn't ratified!
- Need product control

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(TIFO)**

HUMAN  
RIGHTS  
WATCH

Artisanal Gold Mining causes  
Unprecedented Childhood Deaths due to  
Lead Poisoning  
Zamfara, Nigeria 2010-13



University of Idaho





# Extremely isolated villages



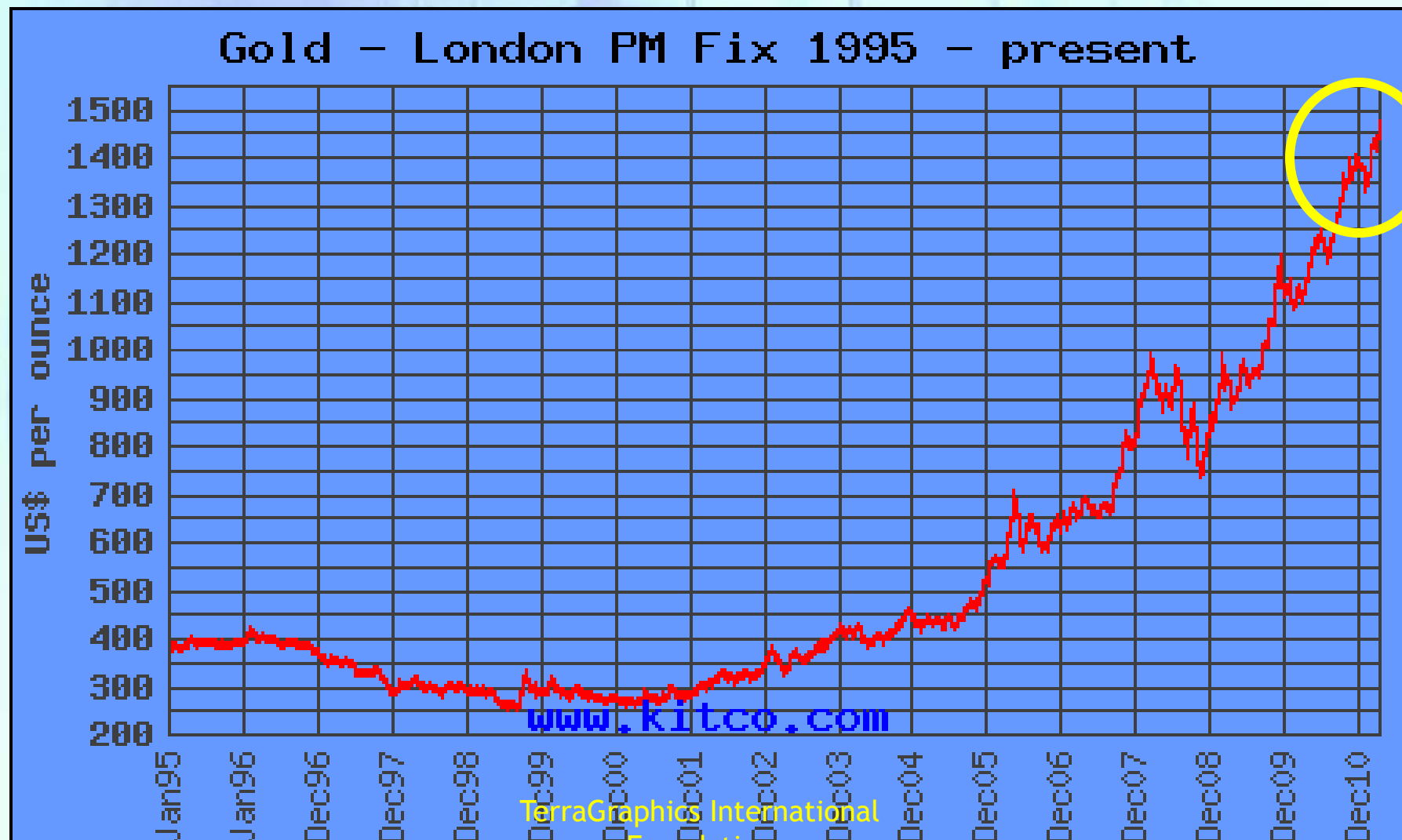
# Perfect Storm

- Price of Gold
- High Lead Content Ore (>10% Pb)
- Primitive Mining Practices / Women's Roles in Local Society



Farming income = \$1-\$3/day

Gold Processing income = \$10 -\$13/day



# Searching for gold in lead mines



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# Zamfara, Nigeria 2010

- Unprecedented Epidemic of Pb Poisoning
- ~ 400 Children Died
- ~ 43% of all children under 5 years
- Blood lead levels 150 - >600 ug/dl (10 ug/dl US Standard)
- Every child & adult tested was lead poisoned
- Long-term irreversible health effects





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All young children ingest Soil; 100 mg/d in US



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Our goal is  
for that soil  
to be clean



Response = UNICEF, NGOs, local, state and federal government of Nigeria

- More to follow on how this happened



# Sampling and Characterization



XRF

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# Cleanup Approach

- Remove contaminated soil from compounds, ponds and exterior areas
- Clean household interiors
- Dispose of wastes in landfills
- Replace areas with clean soils
- Implemented by the ZMoE and Local Government Area (LGA) employing village laborers.







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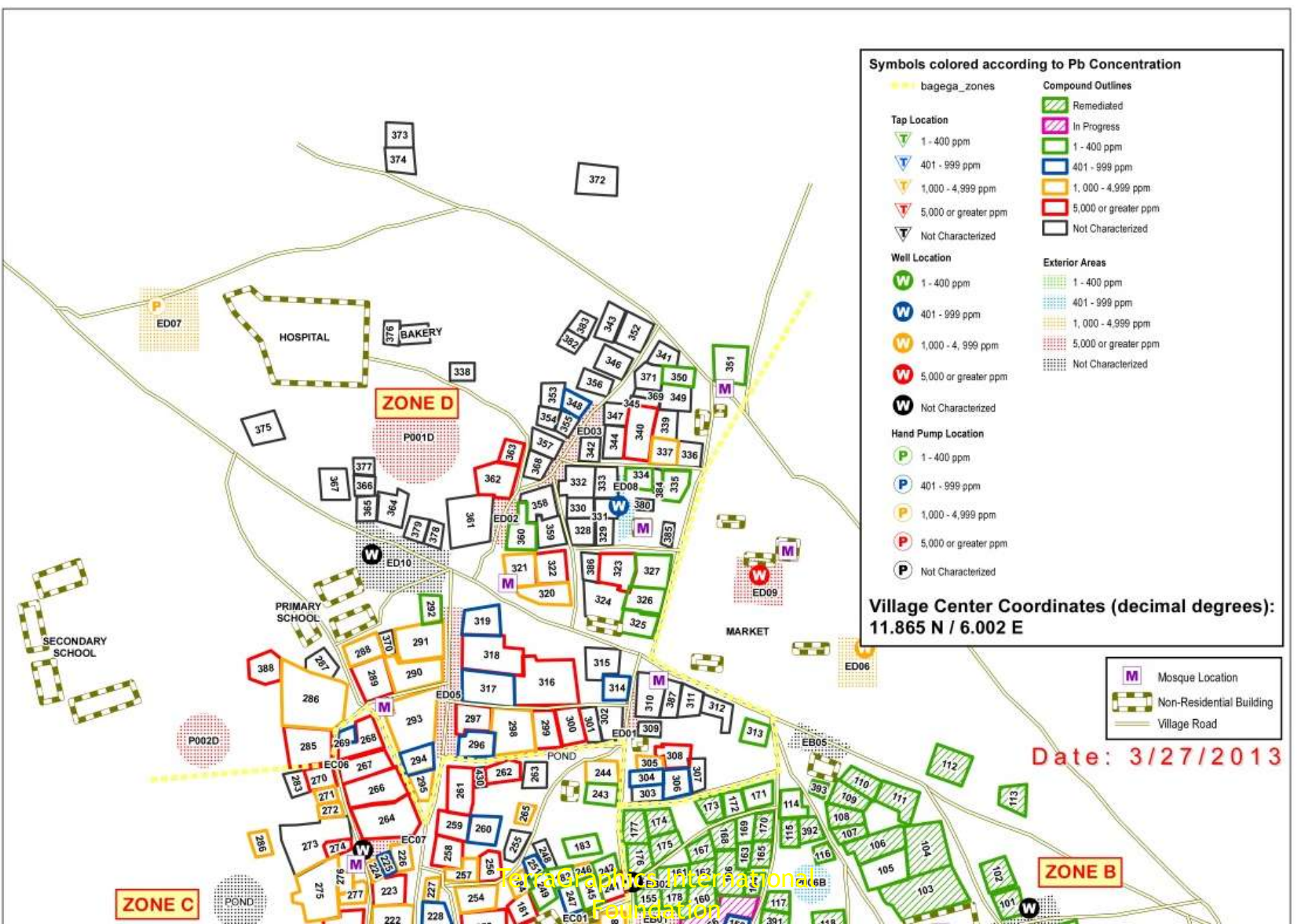
**Symbols colored according to Pb Concentration**

- |                           |                          |
|---------------------------|--------------------------|
| bagega_zones              | <b>Compound Outlines</b> |
| <b>Tap Location</b>       | Remediated               |
| 1 - 400 ppm               | In Progress              |
| 401 - 999 ppm             | 1 - 400 ppm              |
| 1,000 - 4,999 ppm         | 401 - 999 ppm            |
| 5,000 or greater ppm      | 1,000 - 4,999 ppm        |
| Not Characterized         | 5,000 or greater ppm     |
| <b>Well Location</b>      | Not Characterized        |
| 1 - 400 ppm               | <b>Exterior Areas</b>    |
| 401 - 999 ppm             | 1 - 400 ppm              |
| 1,000 - 4,999 ppm         | 401 - 999 ppm            |
| 5,000 or greater ppm      | 1,000 - 4,999 ppm        |
| Not Characterized         | 5,000 or greater ppm     |
| <b>Hand Pump Location</b> | Not Characterized        |
| 1 - 400 ppm               |                          |
| 401 - 999 ppm             |                          |
| 1,000 - 4,999 ppm         |                          |
| 5,000 or greater ppm      |                          |
| Not Characterized         |                          |

**Village Center Coordinates (decimal degrees):  
11.865 N / 6.002 E**

- |                          |
|--------------------------|
| Mosque Location          |
| Non-Residential Building |
| Village Road             |

**Date: 3/27/2013**



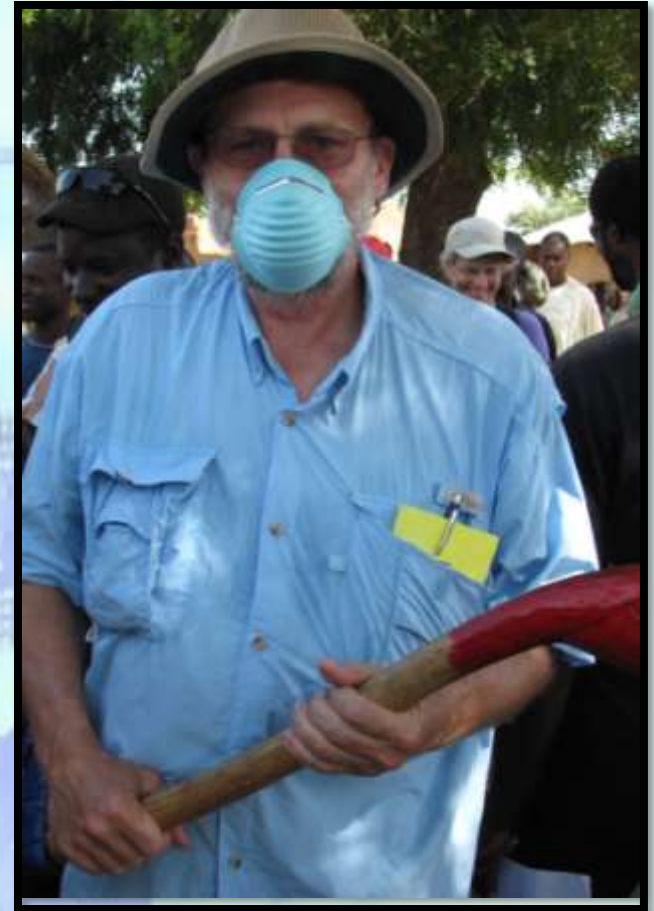
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# Medical Treatment (daily clinics)





# Health and Safety



# Remediation - The Kitchen





# Remediation - Health Messaging/Advocacy





Response = UNICEF, NGOs, local, state and federal government of Nigeria

- Government's solution = "Ban Mining"



# Miners/Remediation Workers





# Miners/Remediation Workers



# Successes

- Community Response Committee
- Brick making ban
- Banned Processing at reservoir
- Community Policing
- Self-remediation
- Requests to map & remediate
- Advocacy by residents
- Ban of children from former highly contaminated areas







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# Response = UNICEF, NGOs, local, state and federal government of Nigeria

- ~\$3 M for cleanup
- Majority was appropriated by the Nigerian government
- Media played a HUGE role

## Lead Poisoning Kills Nigeria Children

By AGENCE FRANCE-PRESSE  
Published: October 6, 2010

ANKA, Nigeria (Agence France-Presse) — More than 400 children



# NEWS AFRICA

5 October 2010 Last updated at 11:02 ET

## Nigeria lead poisoning death toll 'doubles'

At least 400 children have died from lead poisoning in northern Nigeria this year, twice as many as previously reported, the UN says.



Lead Poisoning in Nigeria "Unprecedented"

## Lead Poisoning in Nigeria "Unprecedented"

For a Nation Speeding Forward, Health Is Left Behind

by Joe Amon  
Published in: Global Post  
DECEMBER 2, 2010

## Fallout From Financial Crisis: Thousands Of Nigerian Kids Poisoned By Lead

Categories: Health, Inte



Email Print Share 0 Tweet

## Nigeria: Lead Poisoning Continues to Affect Hundreds of Children in the Northwest

OCTOBER 5, 2010

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When metals prices rise, exposure to metals skyrocket, especially among the poor

- Children are often poisoned in their homes and activity areas
- If we protect the children, we protect the population
- Protocols have been developed and can be applied in low-income countries



# Health Response / Cleanup Protocols

- Site Background Investigation
- Site Characterization Survey
- Exposure Pathways Assessment
- Health Response and Cleanup Strategy
- Industrial and Institutional Controls
- Soil Remediation and Cleanup Activities
- Site Restoration / Economic Development

# Pollution and Poverty

- Just as Pb poisoning is a surrogate for many metals...
- Pollution is a surrogate for addressing problems of poverty, nutrition, human rights, political representation, health care



# Make it work locally

- Hire local people to do the remediation
  - Provide employment
  - Teach health and safety
  - Get security & support for project
- Integrate sustainable remediation into local institutions - don't rely on the magic of outside expertise and money
- Identify the local leaders
- Try to use local equipment and skills

# Summary

- We can respond and remediate
- We respond to emergencies

But...

- What about prevention?
- education?
- laws?
- media?



# Summary

- We can respond and remediate
- We respond to emergencies

But...

- What about access to experts?
- Having reliable data?
- Maintaining high standards?

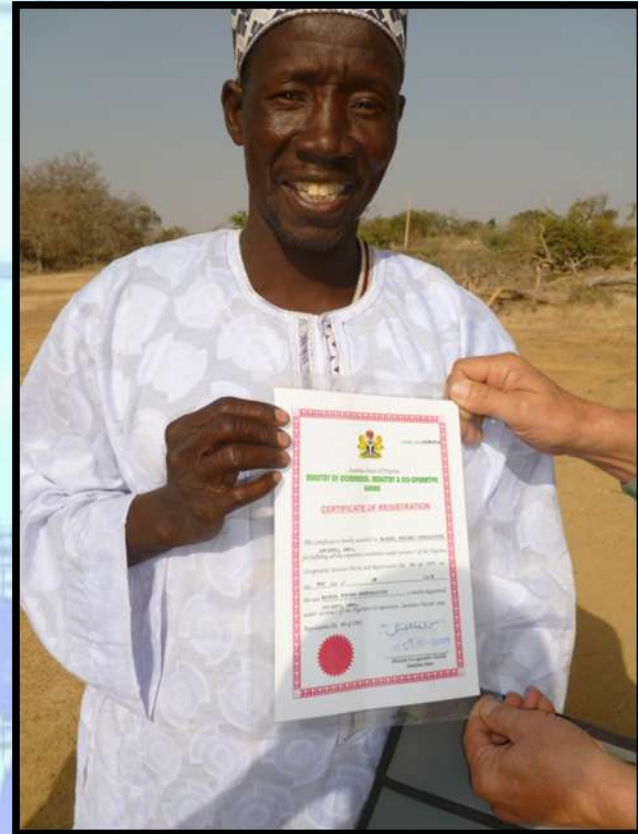
# Paul Farmer, M.D., Idealist

- Partners in Health (Haiti)
- “Mountains Beyond Mountains”
- Do not consider appropriate technology, sustainability and cost effectiveness
- This is human suffering and every poor person deserves the best treatment possible

# Key Networks

- Local Communities
- Educational institutions
- NGOs
- Political leaders
- Attorneys & legal system
- Health officials
- Scientists, engineers
- Media





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# Hope for the Future



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## The Foundation

TerraGraphics International Foundation (TIFO) is a public non-profit organization operating independently of TerraGraphics Environmental Engineering Inc. TIFO specializes in reducing human health risks



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