# Preliminary Site Assessment Dai Bai Craft village and Industrial Cluster, Bac Ninh

CECOD

Bac Ninh, January 2021

*Disclaimer: The training program is organized and co-chair by Bac Ninh DONRE and CECOD, with financial support from USAID through Pure Earth.*

# SITE DESCRIPTION

- Bac Ninh province has 16 industrial zones with the total land area of 6,397ha (of which 10 industrial zones put on operation with the occupancy rate of 70%)
- 29 industrial clusters (of which 27 industrial cluster put on operation with the total land area of 296.38ha), and
- 62 craft villages.

# Bac Ninh location


Bac Ninh province locate in Red River Delta region in the North of Vietnam.

- Adjacent to the North with Bac Giang province.
- Adjacent to the South with Hung Yen and a part of Hanoi.
- Adjacent to the East with Hai Duong.
- Adjacent to the West with Hanoi.

Bac Ninh province beloging to the Northern Key Economic Zone of Vietnam.

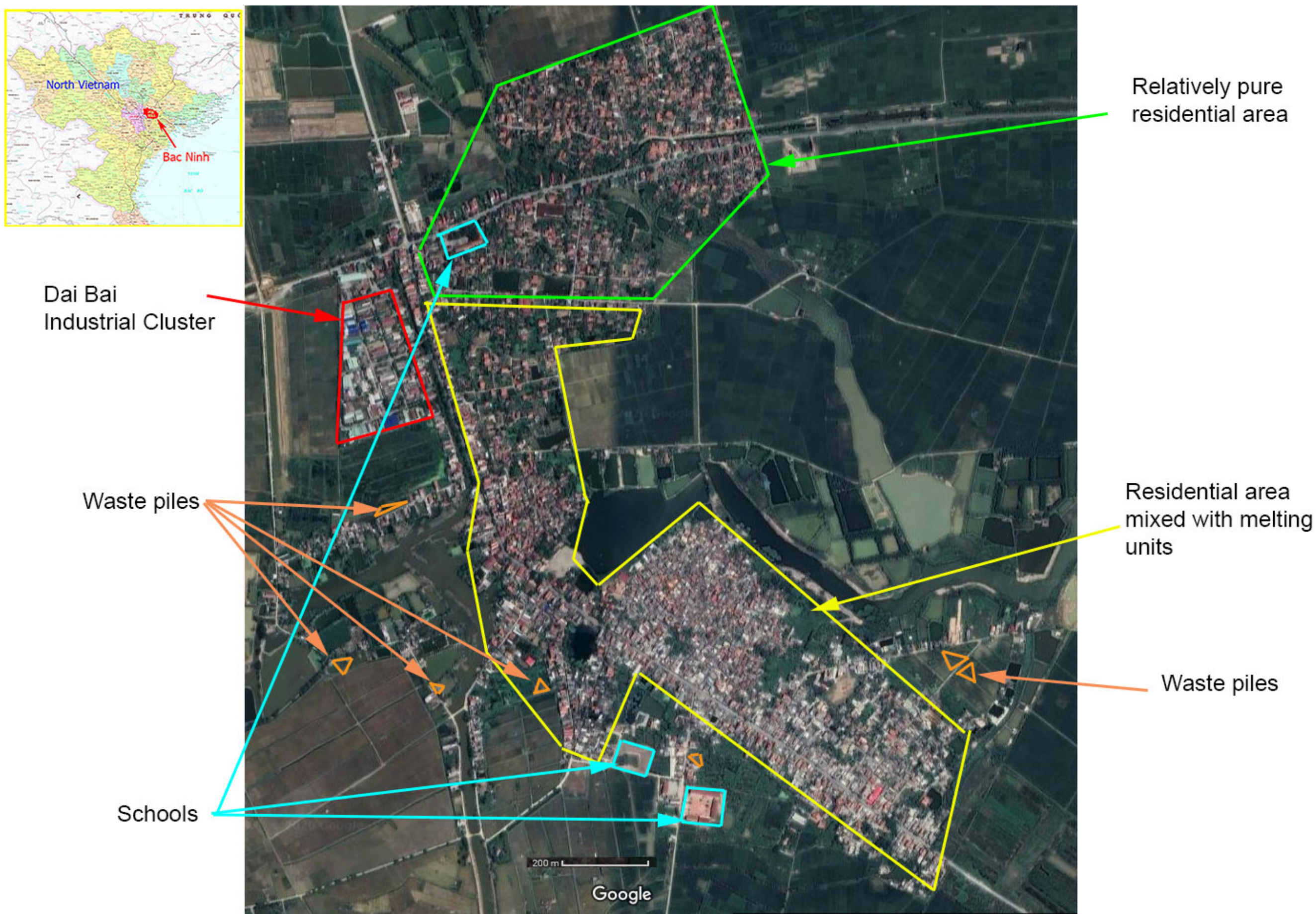
**MAP OF BAC NINH PROVINCE**

**MAP OF NORTHERN VIETNAM**

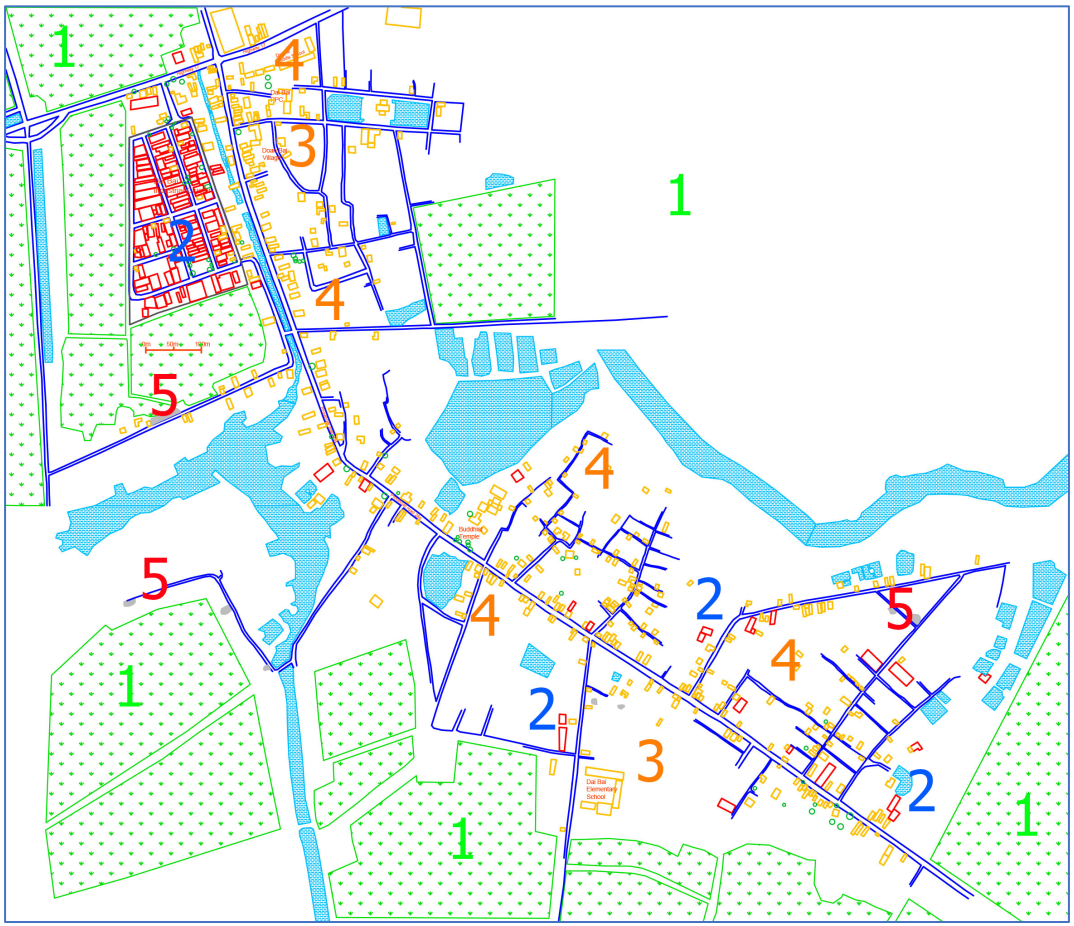
# Dai Bai Commune

- Dai Bai commune of Gia Binh district of Bac Ninh province.
- The population 11,000 people in 2018. Dai Bai commune has area of approximately 619 ha.
- The commune has three villages:
  - Ngoc Xuyen (to the northeast),
  - Doan Bai (to the north) and
  - Dai Bai (from north to south) which is the largest village.
- The bronze craft work in Dai Bai may date back to a thousand years ago, according to the belief of the villagers.

# Dai Bai sectors



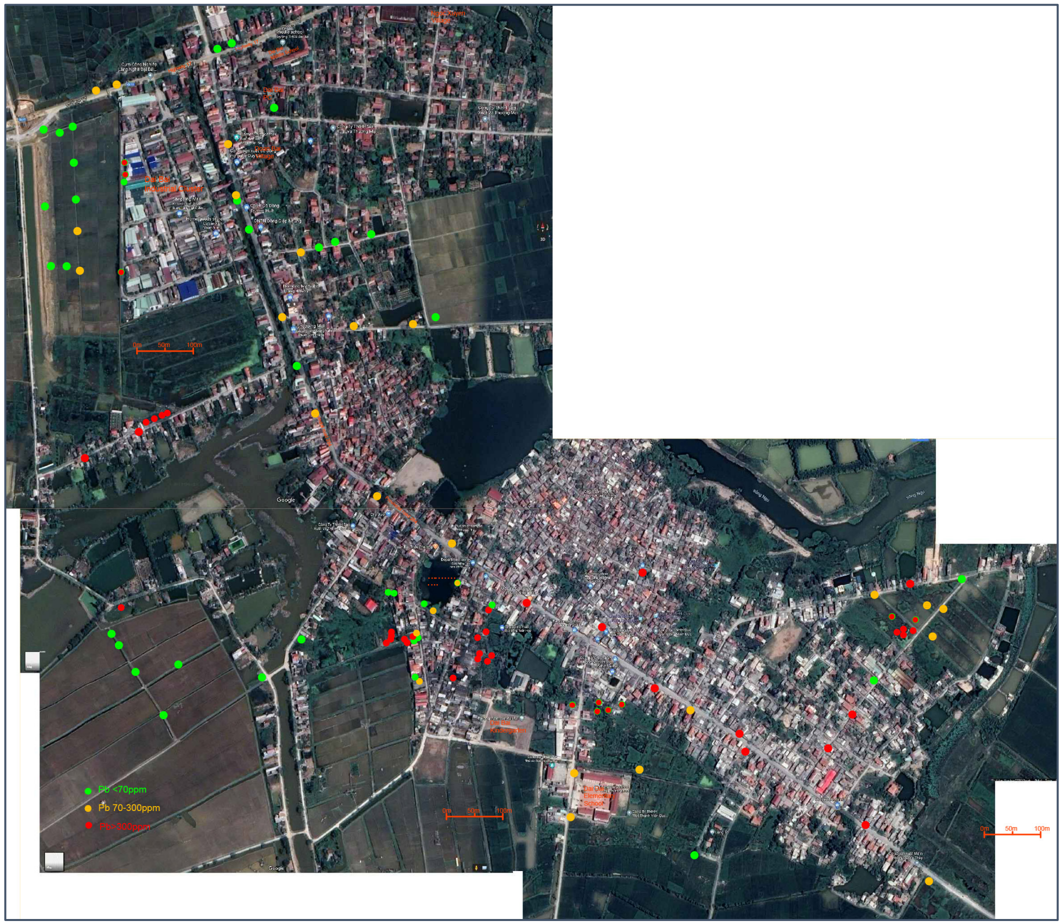
# Dai Bai sectors



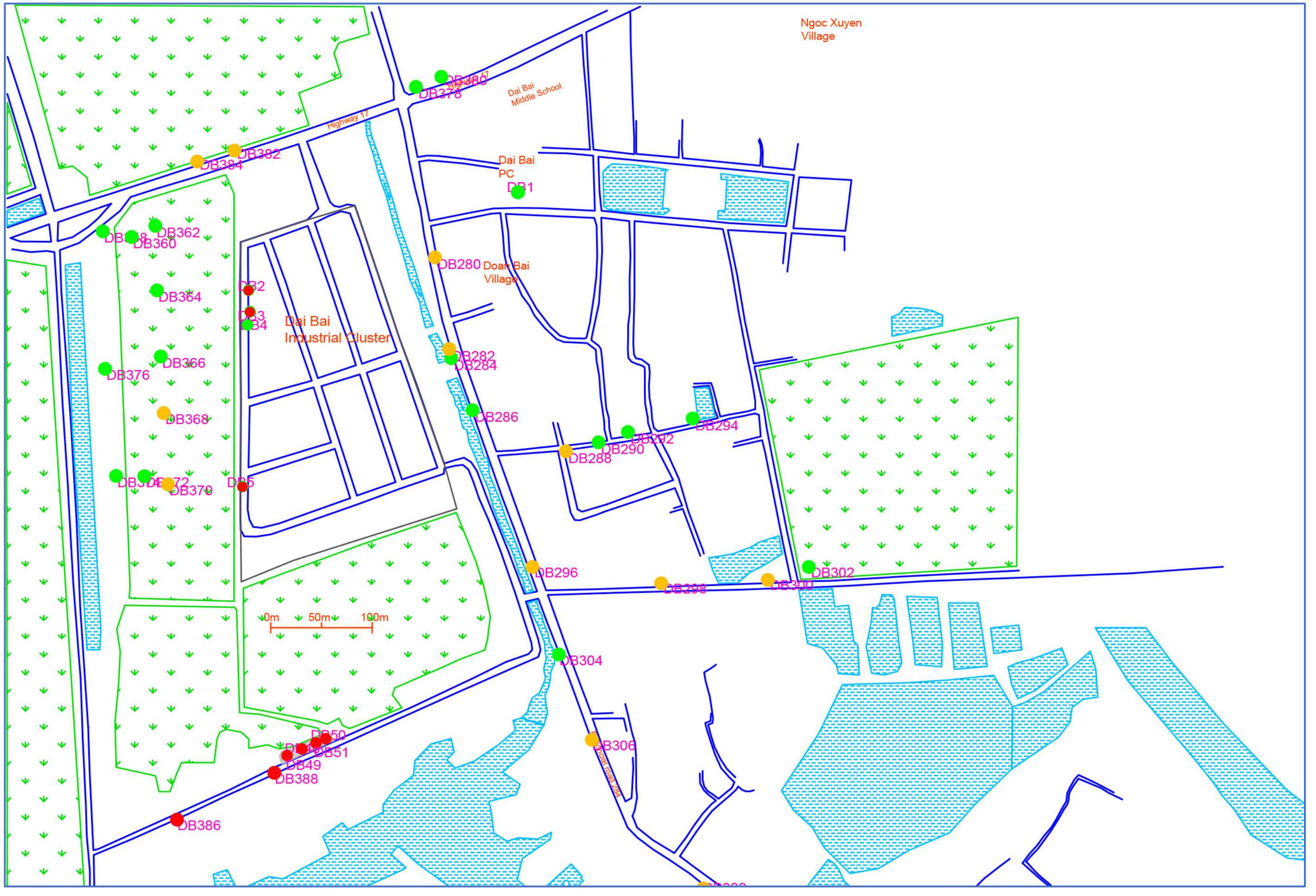
# SAMPLING APPROACH

| Sector Label | Description | Sampling To Be Done |
|---|---|---|
| 1 | Rice fields | Metals in soil by XRF |
| 2 | Industrial cluster and scattered production plants | No soil sampling possible because the area in entirely paved |
| 3 | Public areas such as schools | Metals in soil by XRF |
| 4 | Residential areas | Metals in soil by XRF |
| 5 | Dump sites | Metals in slag by XRF |

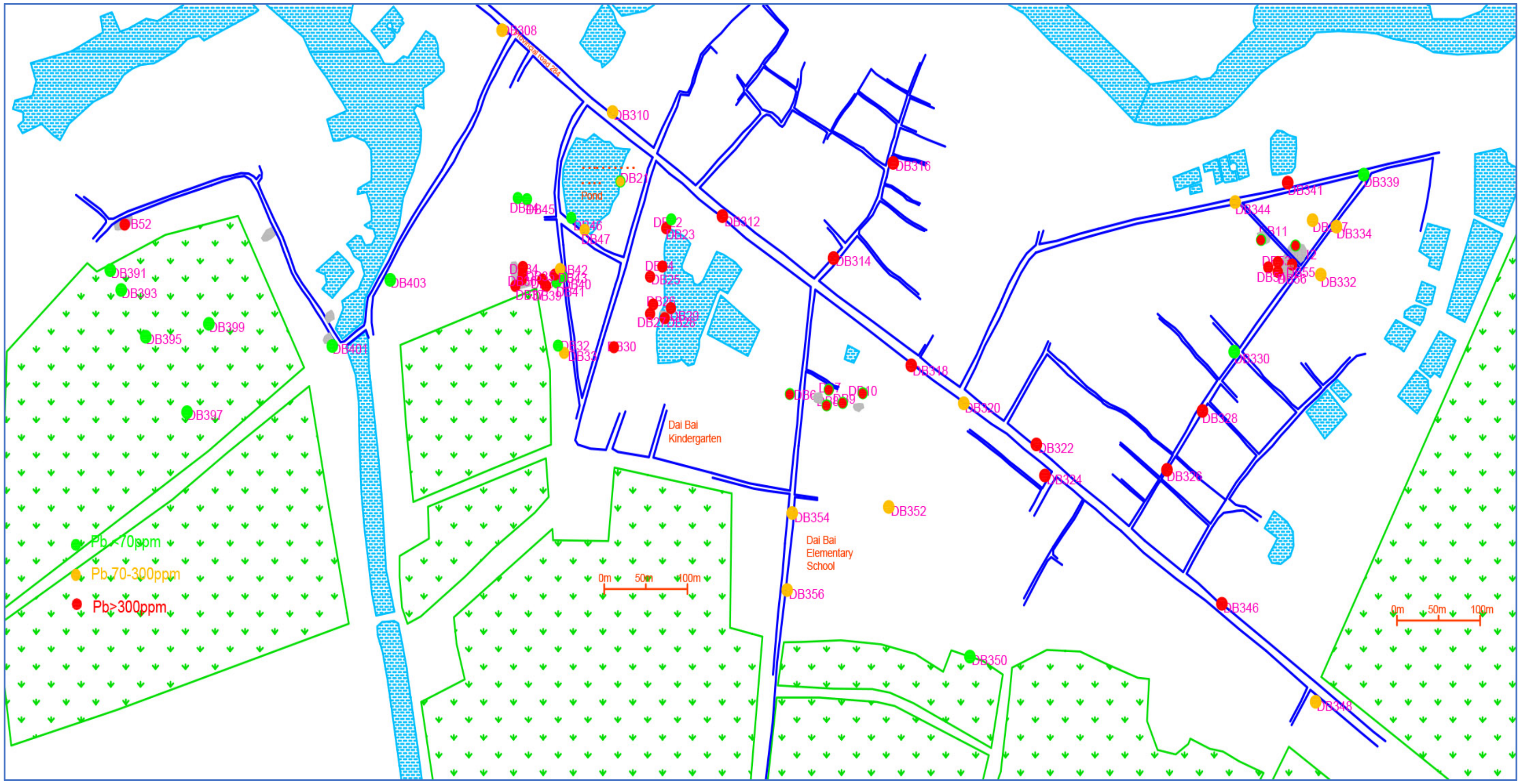
# TEST RESULTS



# Northern part of Dai Bai



# Southern part of Dai Bai



# Slag definitely polluted with lead

| Contaminant | No. of samples | Undetected XRF Readings (%) | No. of XRF readings Above MAC | Mean (mg/kg) | Median (mg/kg) | Range (mg/kg) | Lower Confidence Level | Upper Confidence Level |
|---|---|---|---|---|---|---|---|---|
| Pb | 27 | 0 | 27 | 2763 | 1727 | 106-12155 | 1743 | 3782 |
| As | 27 | 92.6 | 2 | 5.14 | 0 | 0-97 | 0 | 12.53 |
| Zn | 27 | 0 | 27 | 3646 | 1665 | 179-12385 | 2293 | 4998 |
| Cu | 27 | 0 | 27 | 4429 | 806.8 | 140-58908 | 0 | 8960 |

# Soil results diversified

| Contaminant | No. of samples | Undetected XRF Readings (%) | No. of XRF readings Above MAC | Mean (mg/kg) | Median (mg/kg) | Range (mg/kg) | Lower Confidence Level | Upper Confidence Level |
|---|---|---|---|---|---|---|---|---|
| **Pb** | 149 | 7.38 | 138 | 288.2 | 84.18 | 0-8124 | 160 | 416 |
| **As** | 149 | 92.62 | 11 | 5.23 | 0 | 52.44-347 | 0.25 | 10.21 |
| **Zn** | 149 | 0 | 149 | 1987 | 454.37 | 0-54690 | 1031 | 2943 |
| **Cu** | 149 | 10.07 | 134 | 1343 | 218.72 | 0-49565 | 600 | 2086 |

# Classified by area

| Type of Area Sampled | No. of samples <300 ppm Pb | No. of samples >300 and <1,000 ppm Pb | No. of samples >1,000 ppm Pb |
|---|---|---|---|
| **Slag piles** | 2 (1 from copper smelting) | 2 | 8 |
| **Smelter** | 2 (closed former smelters) | 2 | 4 |
| **Road side** | 14 (including 1 by school) | 6 * | 0 |
| **Alley** | 4 | 4 | 1 (near Al smelter) |
| **Garden or yard** | 21 | 6 ** | 3 *** |
| **Field** | 15 **** | 0 | 0 |
| **School** | 2 | 0 | 0 |

# Summary of results

- Test results for the village soil showed low level of leads in the People's committee area, rice fields and vegetable gardens where there is either no production or near active slag piles.
- Soils near active smelters and garden soil next to production workshops or slag piles can be heavily contaminated with lead to the level that the soil is considered hazardous waste by QCVN 07:2009/BTNMT.
- Lead concentrations in soils and dust along the sides of road and in alleys can vary significantly.  Roadside soils may be impacted by spills of waste materials or related to the proximity to smelters and metal shops, although most of the road and alley samples (62%, or 18 of 29 samples) have lead levels below 300 ppm.
- The copper and zinc concentration also exceeded standards for domestic soil. However, the impact of lead contamination on health is more serious.
- Results for all the slag (aluminum dross) piles showed that they are indeed hazardous waste and the lead concentrations in the slag piles pose a significant threat to the villagers.

# Pathways of contamination

- Settling of smoke from smelters
- Fugitive dust from metal working and handling operations, spread by wind
- Spills during transport of slag and waste from smelters and metal working shops
- Road dust – vehicles and wind spread contamination by generating road dust
- Rain runoff carries contaminated soil particles down hill, notably from slag piles
- Particles transported in storm runoff in drainage ditches and channels, which can contaminate land in the event of floods or blockages of channels
- Dust on clothing of workers in metal shops carried off-site
- Dust on shoes and sandals carried off-site
- Dust on tires of trucks, cars and motorbikes carried off-site
- Moving soil with lead contamination during construction and/or excavations in lead-impacted areas

# Receptors

- The primary and by far most important pathway for lead entry into the body is ingestion of contaminated soil, which may occur through:
  - Eating without washing after handling contaminated soils
  - Young children eating soil, chewing fingernails, licking hands etc.
  - Inhalation of dust, then coughing up and swallowing
- Children are most sensitive to lead exposure health impacts, especially age 6 and younger. This is because:
- children have smaller bodies, resulting in greater impact per milligram of lead intake,
- children tend to ingest more dirt, and
- neurological development is still in progress in young children

# POSSIBLE RISK REDUCTION APPROACHES

- Complete allocation of production units into the industrial cluster(s). Workshops in the living area of the commune are more dangerous to people's health because they need no pathway to transfer pollution. Concentrated production units in an area would be much easier to control in terms of environment and other industrial issues.
- Proper management of industrial waste to avoid dumping. There must be a system and equipment to collect slag and waste from smelters and metal shops and to properly dispose of this waste, as opposed to dumping it in piles around the village. Another option is to encourage a circular economy in using aluminum slag (dross) as industrial material for other processes. However, complete recycling does not appear to be feasible.
- Changed practices to reduce or eliminate lead use. Efforts should be undertaken to find a feasible replacement for lead in the aluminum smelting process (lead powders are used as a flux in aluminum smelting).

# POSSIBLE RISK REDUCTION APPROACHES (CONT.)

- Scaling up of production units.  Larger production units have better resources for waste handling, housekeeping to reduce waste, and overall control of pollution.
- Solid waste treatment facility for the commune. Industrial solid waste and domestic solid waste solutions should come at the same time.
- Safe work practice to avoid lead contamination going to homes.  The low cost option is to improve sanitation practices so that workers don't carry dirty clothes and shoes into their homes.
- Land cover with clean soil.  In contaminated garden and yard as shown in analytical results, land covering with geomembrane and clean soil can cut the pathway of contamination.  It is a relatively low-cost option, but it's possible only when the villagers stop discharging new wastes.

# CONCLUSIONS

- Significant levels of lead contamination were found in various areas of the village.
- Testing also showed that lead contamination of soil is also becoming an alarming problem for Dai Bai commune, particularly in gardens or along roads and alleys close to smelters or slag piles.
- Soils in gardens and along further roads continues to be below acceptable levels for lead. Testing also did not find high levels of lead in nearby rice paddies and fields.
- The copper and zinc concentrations often also exceeded standards for domestic soil.
- Risk reduction from lead and other metal exposures can be achieved by:
  - Relocation of production units from residential areas in the village to a larger industrial cluster, and replacing lead-containing aluminum smelting fluxes with non-lead materials.
  - Solid waste management, notably sending newly created slag and the existing waste piles to a proper landfill, is essential to reduce the environmental pollution of the commune.