

April 2020



# Cerro de Pasco

Last Report

**Clinic study on children exposure**

**and environmental monitoring**

**between 2018-2019**

**source**

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## EXECUTIVE SUMMARY

Several studies conducted in Cerro de Pasco in recent years have shown both the extended environmental pollution and the health effects on the community, especially on children.

In the present study, Source International conducted an evaluation of the potential exposure to heavy metals present in water, soil and food in critical areas historically affected by the mining activity. The study includes evaluation of heavy metals exposure around Carhuamayo, located 43 kilometers from Cerro de Pasco.


Carhuamayo was selected as a point of comparison because it has similar climatic conditions, it is approximately at the same elevation, and the nutritional and socioeconomic conditions of the people are similar to those of Cerro de Pasco.

The present study revealed the presence of **lead** in samples of **animal tissue (lamas)** from cattle that graze in the surroundings of Cerro de Pasco and in the vicinity of the Junín National Reserve. Lead absorption in muscle samples of lamas could be associated with the high concentrations of lead found in a soil sample collected from the grasslands between the mining tailings dams.

The current study demonstrates the presence of high concentration of toxic elements such as **lead, mercury, cadmium and arsenic** in soil samples around the city of Cerro de Pasco.

Concentrations of such elements is higher than the background values and than national and international standards; particularly in soils for recreational use (urban parks).

This study has also detected the presence of toxic metals such as **cadmium, lead and arsenic in water rivers** samples of Cerro de Pasco in concentrations higher than both the background values (Carhuamayo) and national and international quality standards. High concentrations of potentially toxic metals such as thallium and antimony have also been found. The final segment of the Ragra River, in Yurajhuanca, is the most impacted water resource by heavy metals including cadmium, arsenic and lead. Multiple sources contributing to pollution in this microbasin. No toxic metals have been found in tap water.



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# EXPOSURE BIOMARKERS

Once heavy metals are absorbed by the organism, they are distributed in the body through the blood to the tissues. The main excretion pathways are renal and gastrointestinal and secondly through salivation, exhalation, transpiration, breastfeeding and accumulation in nails and hair. Some organs (bones, liver and kidney) sequester certain metals in relatively high concentrations for years. Arsenic mercury, lead and cadmium are the most toxic metals.



Communities in Cerro de Pasco

## BLOOD

- The highest incidence of lead in blood  $> 10 \mu\text{g}/\text{dl}$  in: Ayapoto, Quiulacocha, Champamarca y Paragsha.<sup>1</sup>
- Extremely high level ( $60\text{-}120 \mu\text{d}/\text{dl}$ ) in Yanacancha.<sup>2</sup>
- 93% of the mine workers and 83% of the concentrator plant workers had lead poisoning above  $20 \mu\text{g}/\text{dl}$ .<sup>3</sup>
- Blood lead levels even below  $5 \mu\text{g}/\text{dl}$  can produce effects on mental health.<sup>4</sup>

## URINE



- Highest levels of arsenic, cadmium, mercury in urine in 2017 above law level.<sup>5</sup>
- 2018 arsenic in creatinine above law level.<sup>6</sup>

1. Activos Mineros S.A.C (AMSAC), 2019

2. Dirección Regional de Salud (DIRESA) Pasco, 2008. Ayuda de Memoria sobre el Problema de Plomo en Cerro de Pasco

3. Tarazona, C. 2017. Niveles de plomo en sangre y su influencia en el estado del periodonto de trabajadores en las empresas mineras de Cerro de Pasco – 2010.

4. NTP, 2012. Monograph on Health Effects of Low-Level Lead.

5. DIRESA Pasco, 2017. Informe final de las actividades desarrolladas en la declaratoria de emergencia sanitaria D.S. No. 020-2017-SA y 029-2017-SA.

6. DIRESA Pasco, 2018. Informe final de las actividades desarrolladas en la declaratoria de emergencia sanitaria D.S. No. N° 005-2018-SA.



# HAIR

Case-control study to assess the different degrees of exposure to heavy metals in two child populations: Paraghsa (exposed) and Carhuamayo (not exposed-40 km far from Cerro de Pasco).

21 metals analyzed  
196 children monitored  
across 2016-2018

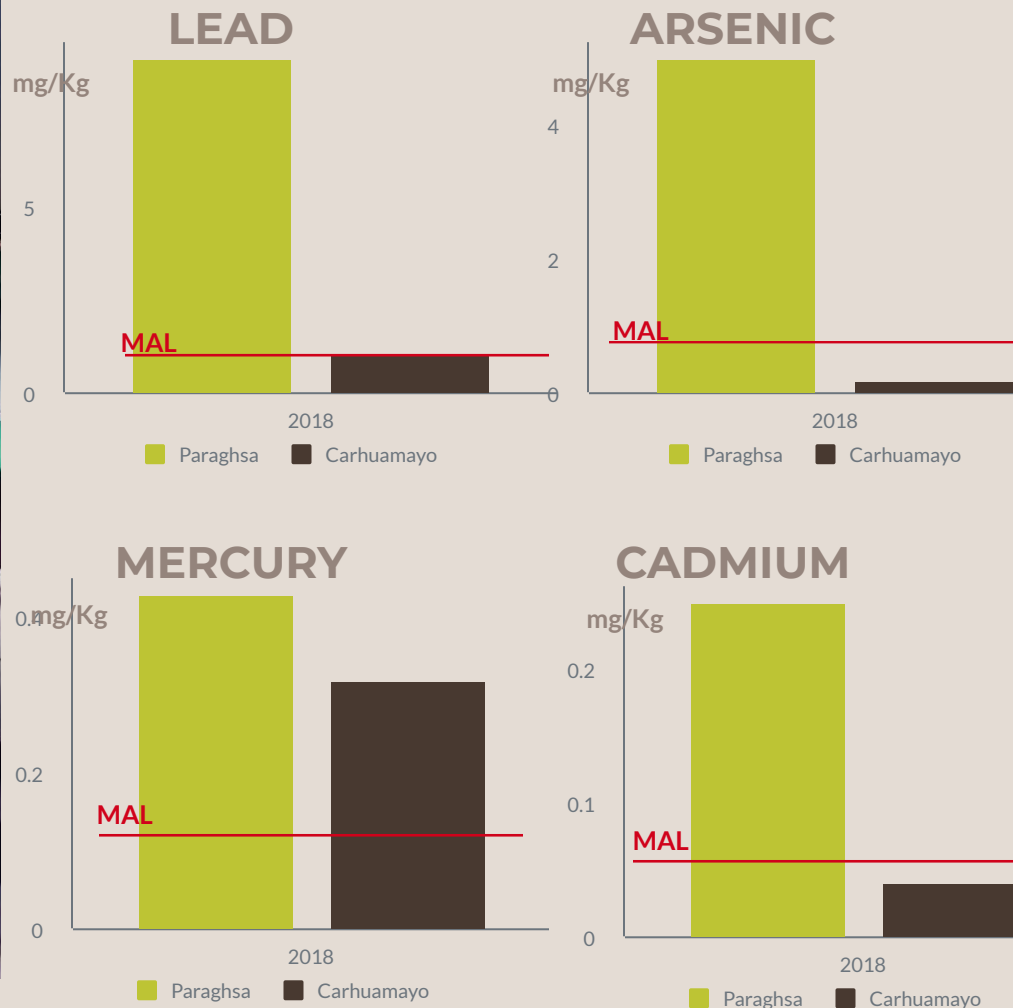


Sampling hair of Paraghsa's children (2018)

## 1 CROSS SECTIONAL STUDY

Average concentrations of **lead** in hair in children of Paraghsa in 2018 exceeded 6 times the average of Carhuamayo; **cadmium** exceeded twice and **arsenic** 3 times. In addition, lead proved to be **46** times higher than the Maximum Acceptable Level (MAL) established by the German laboratory (MicroTrace Minerals), while **arsenic** was twice as high.

**Tin** in Paraghsa showed 381 times more than the average of Carhuamayo, while **antimony** was 2 times; **thallium** proved to be double of Carhuamayo. In addition, **nickel** exceeded 2 times, and **aluminum** 4 times the (MAL) of the German laboratory.

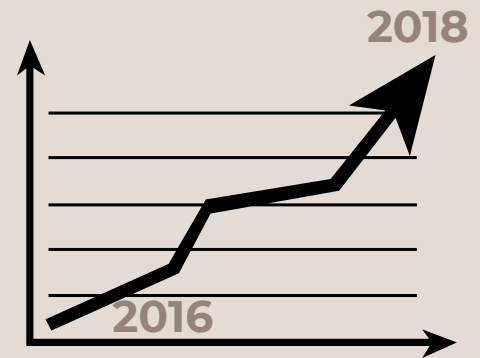


## 2

# LONGITUDINAL STUDY

In 2018 the levels of potentially toxic metals such as **tin** and **nickel** respectively exceeded more than 300 and 10 times the levels of 2016; however, there was no statistically significant increase in the concentrations of toxic metals (lead, arsenic, mercury and cadmium).

The average concentration of **selenium** has quintupled; that of **chrome** truplicated and that of **manganese, iron, cobalt, vanadium** and **zinc** doubled.



In most elements we observed a trend of increasing concentration between November 2015 and March 2017.

The movement of the dismantling of oxidized waste (Parcela A) for the processing in the Oxides plant, which began the operations in June 2015, can be a possible cause of the increase of the human exposure.





# CLINIC INVESTIGATION

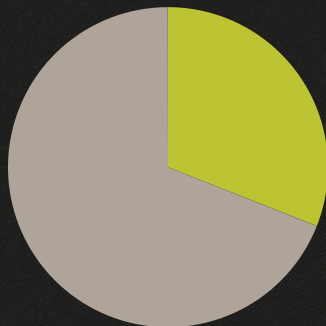


Parallel to the analysis of hair samples as a possible biomarker of metal exposure, a clinical investigation of exposed children was carried out. For this, complete physical examinations, external examinations and anamnesis (clinical history) of both cohorts were performed in order to assess a potential correlation between chronic exposure to heavy metals and the development of some clinical manifestations that may be associated.

## CLINIC SYNDROME

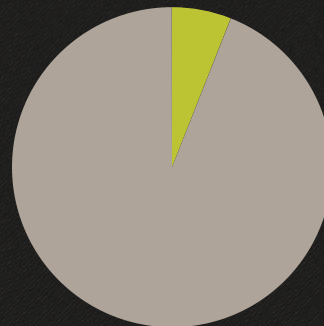
blue gum line, inflamed conjunctivitis, calluses

Paraghsa



■ YES (31%) ■ NO (69%)

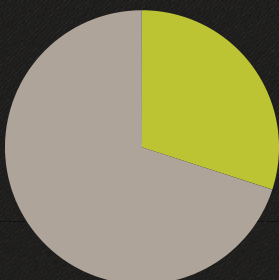
Carhuamayo



■ YES (6%) ■ NO (94%)

## WHITE LINES NAILS

Paraghsa



■ YES (30%) ■ NO (70%)

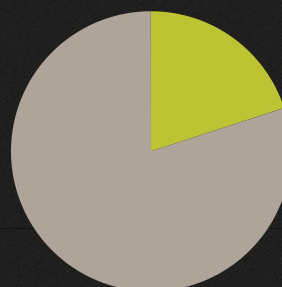
Carhuamayo



■ NO (100%)

## ALTERATED MOOD

Paraghsa



■ YES (20%) ■ NO (80%)

Carhuamayo



■ NO (100%)



# RICREATIVE SOIL

Calle Huancavelica in Paraghsa



In the soil sample of the playground in Calle Huancavelica de Paraghsa it was found that there were **17 times more lead**, **14 times arsenic** and **7 times more mercury** than in the schoolyard of Carhuamayo. Arsenic and lead levels in Paraghsa parks doubled ECA levels (Peruvian Environmental Quality Standard).



The analysis of metals in recreational soil shows that there are **34 times more lead**, **26 times more arsenic** and **23 times more cadmium** in the schoolyard of the Educational Institution in Champamarca than in the courtyard of the Technical School in Carhuamayo. Lead levels exceed **4 times the ECA** for soil, while the **arsenic level is 3 times higher**.

# GRAZING SOIL

Grassland area between the Ocroyoc tailings and the town of Quiulacocho, Ragra River microbasin presented **54 times more mercury**, **27 more arsenic**, **25 times more lead** and **21 times more cadmium** than the average in agricultural soils of Carhuamayo.

In agricultural land of grasslands, in the sub-basin of the Tingo River we found **19 times more lead**, **10 times more cadmium**, **6 times more arsenic** and **twice mercury** than the average of agricultural land in Carhuamayo.



Agricultural soils in Tingo basin

➤➤ The presence of high concentrations of lead and arsenic in soil samples of the playground in Calle Huancavelica de Paraghsa suggest that the contaminated soil may constitute a route of exposure to the children and can explain the high concentration of those elements in children's hairs.

# WATER



*Ragra River in San Juan sub-river basin*

**3 RIVER BASIN MONITORED  
with  
17 WATER SAMPLED:**

**1 SPRING WATER**

**4 TAP WATER**

**2 MINE TAILINGS**

**2 WASTE WATER**

**8 RIVER POINTS**

## RIVER WATER

### **Tingo River**

It has 31 times more manganese, 10 times more antimony, and twice arsenic, compared with Carhuamayo river just below the Yanacocha lake. 10 times more zinc and three times more lead were found than those established in the ECA for the conservation of the aquatic environment in rivers, while manganese levels tripled the ECA for water for population and recreational use.

### **San Juan River**

13 kilometers downstream of the confluence with the Ragra River, water has 354 times more manganese, 7 times more antimony and twice as much arsenic then in the Carhuamayo River sample.

2 kilometers upstream of Lake Chinchaycocha the water showed to have 7 times more manganese, 6 times more antimony and twice as much arsenic and barium then in the Carhuamayo River sample. In addition, lead concentrations exceeded ECA 12 times.

### **Ragra River**

Compared to the sample collected in the Carhuamayo River, the water of the river ragra in Yurahuanca has more than 2000 times more manganese, 16 times more antimony, and 4 times more arsenic (which is also 10 times greater then ECA). In addition, manganese levels exceed 220 times the ECA; which are also exceeded for iron (10 times), cadmium (5 times), and twice for lead.



## MINE TAILINGS



### QUIULACOCHA

Rich in manganese, zinc and iron. More than 275 times the level of cadmium, 63 times that of arsenic and 34 times the level of mercury established in the ECA for the conservation of the aquatic environment in lakes.

*Quiulacocha mine tailing*

### YANAMATE

pH of 2.4 (almost 100.000 times more acid than the law limit). Rich in iron, zinc, manganese and aluminum, among other metals.

81 times more lead, 37 times more arsenic and 19 times more cadmium than what was established in the ECA for the conservation of the aquatic environment in lakes. Other metals that exceed ECA levels include zinc (1200 times) and copper (125 times), while aluminum exceeded 16 times the levels recommended by the EPA for the protection of aquatic life.

In the samples of water for consumption collected in **Paragsha and San Juan** none of the metals exceeded the standards established by the regulation of water quality for human consumption of the D.S. N° 031-2010-S.

The arsenic concentration in **water spring in Yurajhuanca** exceeds the limit of the ECA standards for population and wealth use and also the limits for national and WHO drinking water.

## DRINKABLE WATER



*Yurajhuanca Spring water monitoring*

➤ Since no high concentrations of tin, lead, nickel or aluminum have been found in potential sources of water for human consumption, in general, there is no statistically significant positive correlation with respect to the distribution of metals present in hair samples in Paragsha. The ingestion of tap waters could be considered an incomplete route of exposure to metals.

# FOOD



*Lama grazing in Quiulacocha*



*Lambs grazing in Yurahuanca*

The highest concentrations of **lead** among all samples were found in the **alpaca muscle** sample of the Junín National Reserve. These concentrations were slightly higher than those of the **lama muscle** sample that graze around the San Juan River in Cerro de Pasco. Both samples exceed more than 10 times the standards recommended by the Codex Alimentarius of the Food and Agriculture Organization of the United Nations (FAO) and WHO, and Regulation No. 1881/2006 of the European Commission.



Lead absorption in muscle of lamas grazing in Yurajhuanca could be associated with the high concentrations of lead found in soil collected from the grasslands between the Ocroyoc tailings and Quiulacocha. There could be a causal relationship between the lead levels of the cattle samples in the Junin Reserve and the high concentrations of lead measured in waters of the San Juan River.



# RECOMMENDATIONS

## LOCAL AUTHORITIES

- Public consultations and promote citizen participation in the development, implementation and monitoring of mitigation
- Develop procedures together with educational institutions and parents to identify and intervene those cases in which children have been exposed to heavy metals.

## DIRESA Pasco

Establish a long-term environmental epidemiological surveillance (biomonitoring) plan in the Simón Bolívar District that includes the implementation of early intervention plans (from blood lead levels of 5 ug /dl), effective and inclusive through specialized staff.

## CENSOPAS

Provide biomonitoring results in a transparent and timely way to DIRESA Pasco in order to carry out intervention plans within the established deadlines and budgets.

## MINSA

Ministry of Health has to ensure that DIRESA Pasco has the necessary resources to provide follow-up care for children with elevated blood lead levels, evaluate sources of exposure and provide neurological and intellectual development assessment services for the most exposed children.

## OEFA

- Measurement of sedimentable particulate material and metals within its program of environmental monitoring of air quality in the Paragsha or other locations in Cerro de Pasco.
- Environmental monitoring in San Juan and Tingo River sub-basins, in particular in the Ragra River microbasin and its tributaries. This monitoring should consider the evaluation of water quality on a seasonal basis that includes events of maximum runoff.

## MINEM

To the Ministry of Energy and Mines (MINEM) is recommended to continue with the plans and execution of the closure and remediation of the Excélsior Dump and the Quiulacocha Relavera, important environmental liabilities that have historically contributed to the levels of pollution present today in the waters and soils of Cerro from Pasco.



## **CERRO DE PASCO Last Report**

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monitoring between 2018-2019**

**Produce by: Source International**

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**Materials collected with Centro de Cultura Popular Labor**

**April 2020**

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