UNIVERSITI PUTRA MALAYSIA

THE IMPACT OF SOIL POLLUTION ASSOCIATED WITH BAUXITE MINING ACTIVITY ON FOOD SAFETY AND HEALTH RISK IN MALAYSIA

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INTRODUCTION

THE STORY

How everything started

Bauxite is a mineral, reddish clay - contain 15-25% aluminium [1].

Undiscovered bauxite resources - 55-75 billion metric tons.

In tropical regions, lateritic bauxite or silicate bauxites ores are largely formed by the weathering process of silicate rocks.

These ores contain the highest concentration of aluminum compared to karst or carbonate bauxites [1].

INTRODUCTION

THE STORY

How everything started

Bauxite mining has started in early 2000 at Teluk Ramunia, Johor, the South of Peninsular Malaysia (MGDM, 2010).

Kuantan has recently become the new mining sites for bauxite in 2014.

18,000 ha of the area covered with basalt (Kusin et al., 2017; Paramananthan 2000).

THE CONFLICT

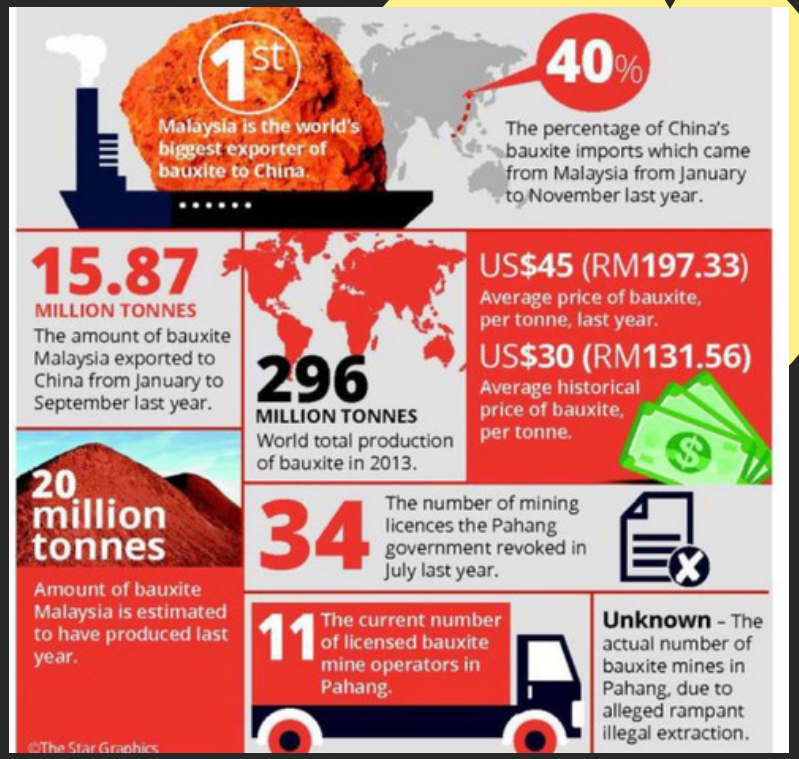
WHAT IT'S ALL ABOUT

A short summary

Bauxite is refined to produce alumina (Al2O3) - reduced to metal aluminium (Al) [2]

Al is widely used for manufacturing many industrial goods. Continuing demand for mineral supply - spurred the mining industry in Malaysia.

Metallic mineral sector in Malaysia includes iron ore, manganese, gold, tin, and other byproducts of tin and gold [3].



THE MAJOR CONCERN

18,000 ha area in Kuantan (including Bukit Goh) - heavily mined for bauxite [4].

Kuantan - basalt composed of Al_2O_3 (12–13%), Fe_2O_3 (3–6%), FeO (7–8%), TiO_2 (1–2%), Cr_2O_3 (0.02%) and NiO (0.01%) [5 -6].

Physical impacts to the environment - water, air, soil, animals and human health [7-9].

Bioaccumulation of heavy metals in soil - food chain - significant impact to food safety and security [10-11]

SOIL ASSESSMENT

METHOD

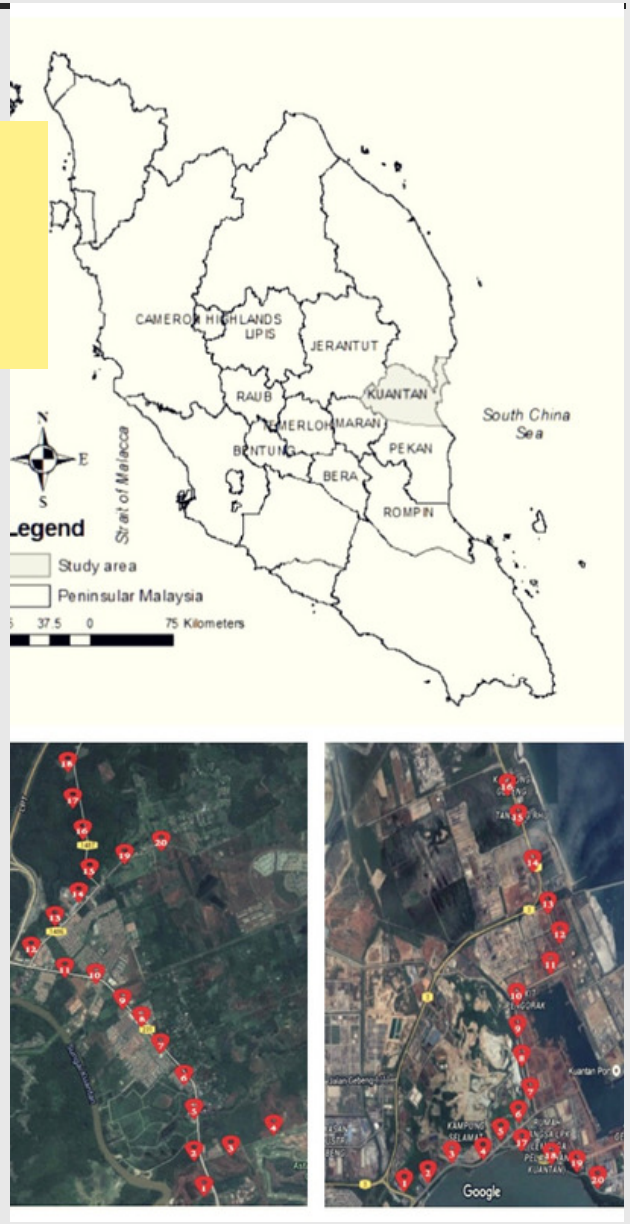
Where it all began

40 sampling stations - around Bukit Goh (the mining area) & Kuantan Port (Stockpile area) in Kuantan Malaysia

December 2015 to February 2016 during the temporary cessation of the bauxite mining activity.

Analyzed using high definition X-ray fluorescence (HDXRF®) HD Rocksand XOS's.

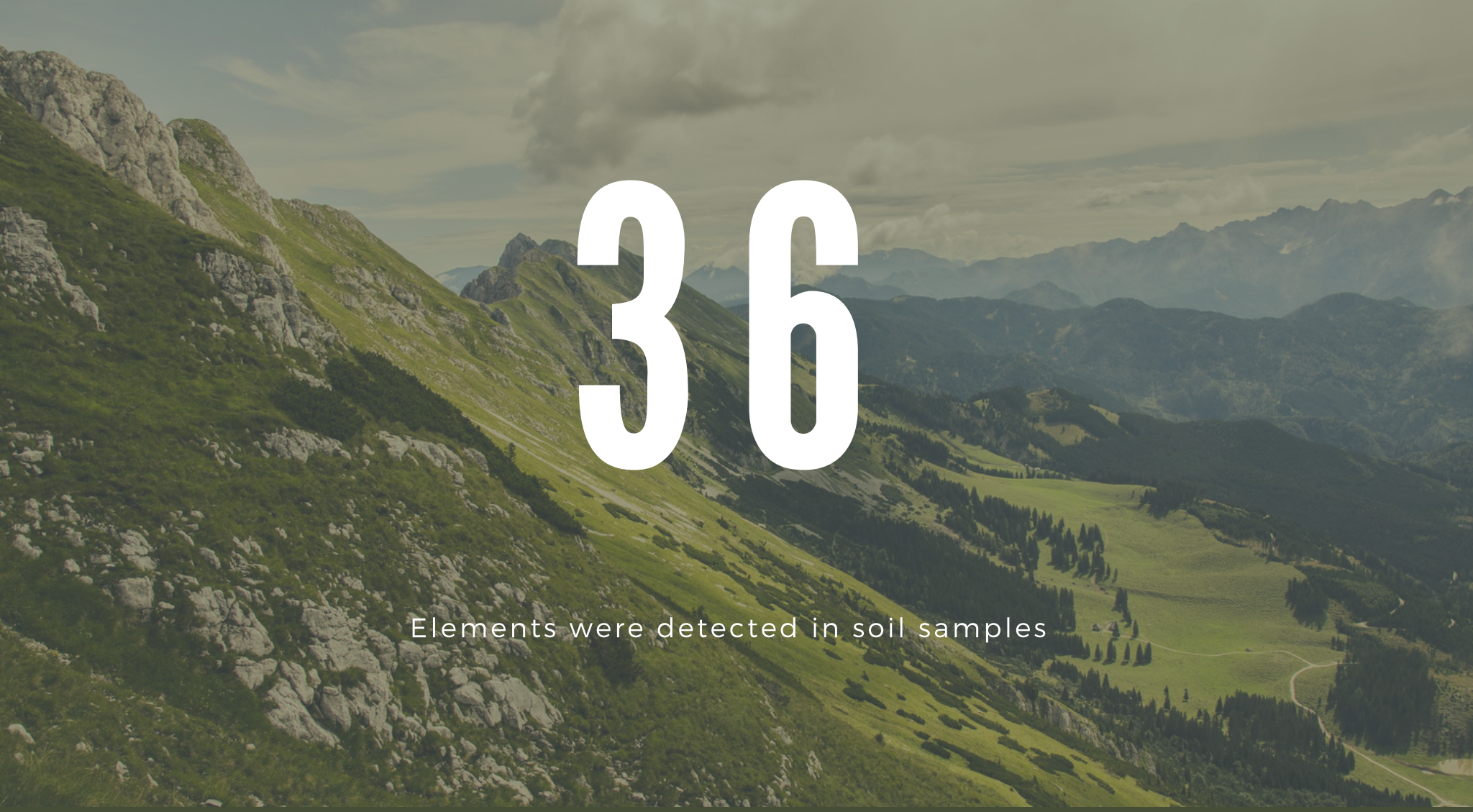
Health risk was calculated using mathematical equation from USEPA.



Soil pollution

FINDINGS

FOOD SAFETY



36

Elements were detected in soil samples

6

Carcinogenic elements i.e.Cr, Ni, Pb, As, Cd, Se

12

Non-carcinogenic elements i.e. Fe, Cu, Zn, Hg

18

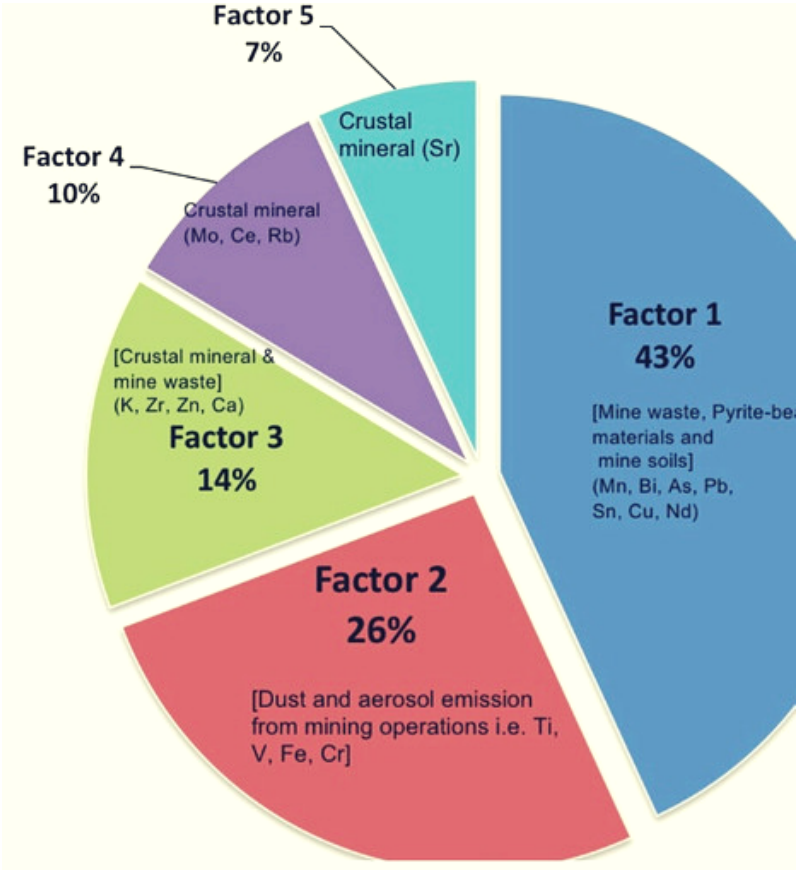
Tracers elements i.e. Si,Ti, V, Ag

> 85%

Samples exceeded the Dutch Soil Standard and higher compared to previous studies

43%

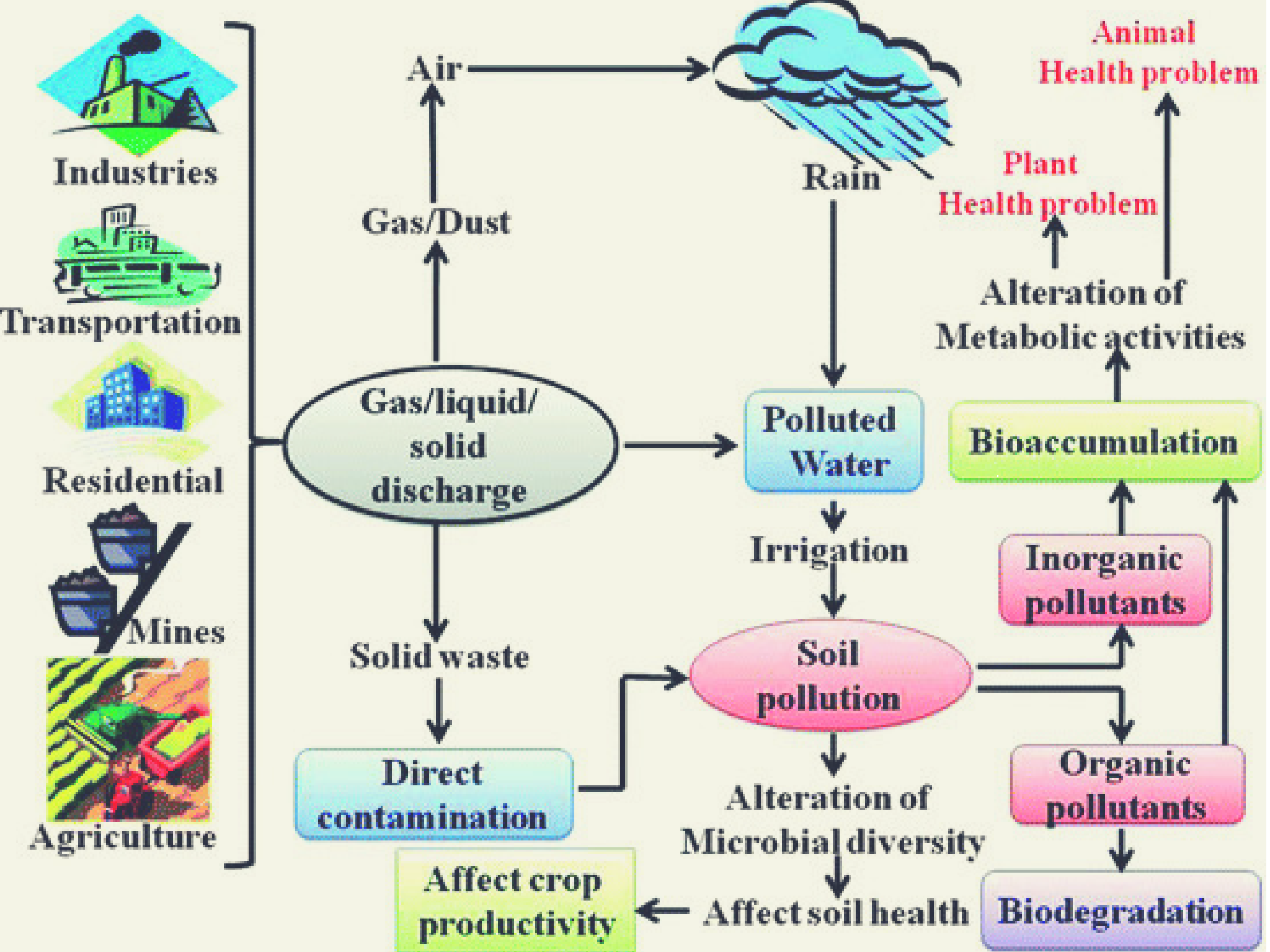
Of the elements are from mine waste



HOW THIS RELATE TO FOOD SAFETY & ONE HEALTH?

Historical case study;

Example: Minamata disease, Itai-itai disease


Industries
Transportation
Residential
Mines
Agriculture
Air
Gas/Dust
Rain
Gas/liquid/
solid
discharge
Polluted
Water
Irrigation
Solid waste
Direct
contamination
Soil
pollution
Alteration of
Microbial diversity
Affect soil health
Affect crop
productivity
Animal
Health problem
Plant
Health problem
Alteration of
Metabolic activities
Bioaccumulation
Inorganic
pollutants
Organic
pollutants
Biodegradation

HEALTH RISK

NON-CARCINOGENIC RISK

The overall non-carcinogenic risk assessment on the health is indicated as more risk via the inhalation route in the stockpile area (HI = 10.7) as compared to in the mining sites (HI = 4.51).

CARCINOGENIC RISK

are higher than the tolerable level (1E-06 to 1E-04) [25,15]., Cr appears to be the main contaminant with the potential to cause cancer amhrough ingestion.

BIO-ACCUMULATION

These metals can accumulate and disturb food chain

Starting early

CONCLUSION

Significant impact can be seen from bauxite mining activity to environment and human.

Mitigation measures need to be planned to reduce the impact now and future

THANKS FOR LISTENING