OP KŽP

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MINISTRY OF ENVIRONMENT OF THE SLOVAK REPUBLIC

SLOVAK ENVIRONMENT AGENCY

SLOVAK ENVIRONMENT AGENCY

is implementing an activity

INTERNATIONAL CONFERENCE
CONTAMINATED SITES
ZNEČISTENÉ ÚZEMIA
MEDZINÁRODNÁ KONFERENCIA

INTERNATIONAL CONFERENCE

CONTAMINATED SITES 2018

BANSKÁ BYSTRICA, SLOVAK REPUBLIC, 8 – 10 OCTOBER 2018

The activity has been implemented within the framework of national project
***Information and providing advice on improving the quality of environment in Slovakia**.*
The project is cofinanced by Cohesion Fund of the EU under Operational programme Quality of Environment.

www.op.kzp.sk *www.minzp.sk* *www.sazp.sk*

CONTAMINATION ISSUES OF ARMENIA's MINING SITES

Lilit Sahakayan, G. Tepanosyan, A. Saghatelyan
Center for Ecological-Noosphere Studies, Armenia
lilit.sahakyan@cens.am, www.cens.am

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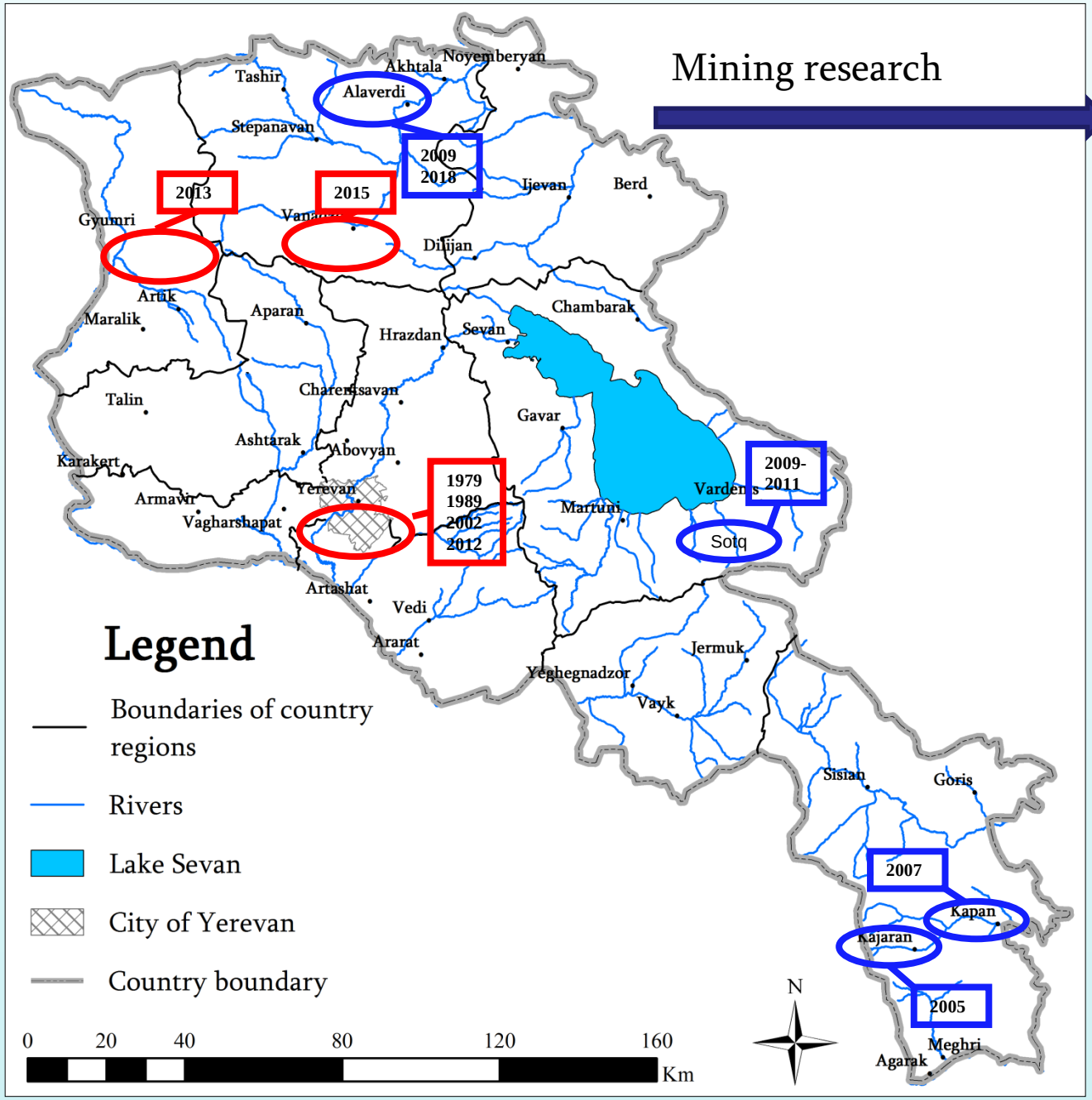
SLOVAK ENVIRONMENT AGENCY

Geochemical surveys & complex investigations



Armenia's position on the world map

Brief information about Armenia

Area - 29.74 thous. sq.km

Maximal extension - 365 km

Population - 3.2 mln

Capital - Yerevan

Highest point - 4090 m a. s. L., Aragatz Mt.

Lowest point - 380 m a. s. L., Debet r. canyon

Climate - dry continental

Mining

670 solid mineral deposits

Including 30 metallic deposits

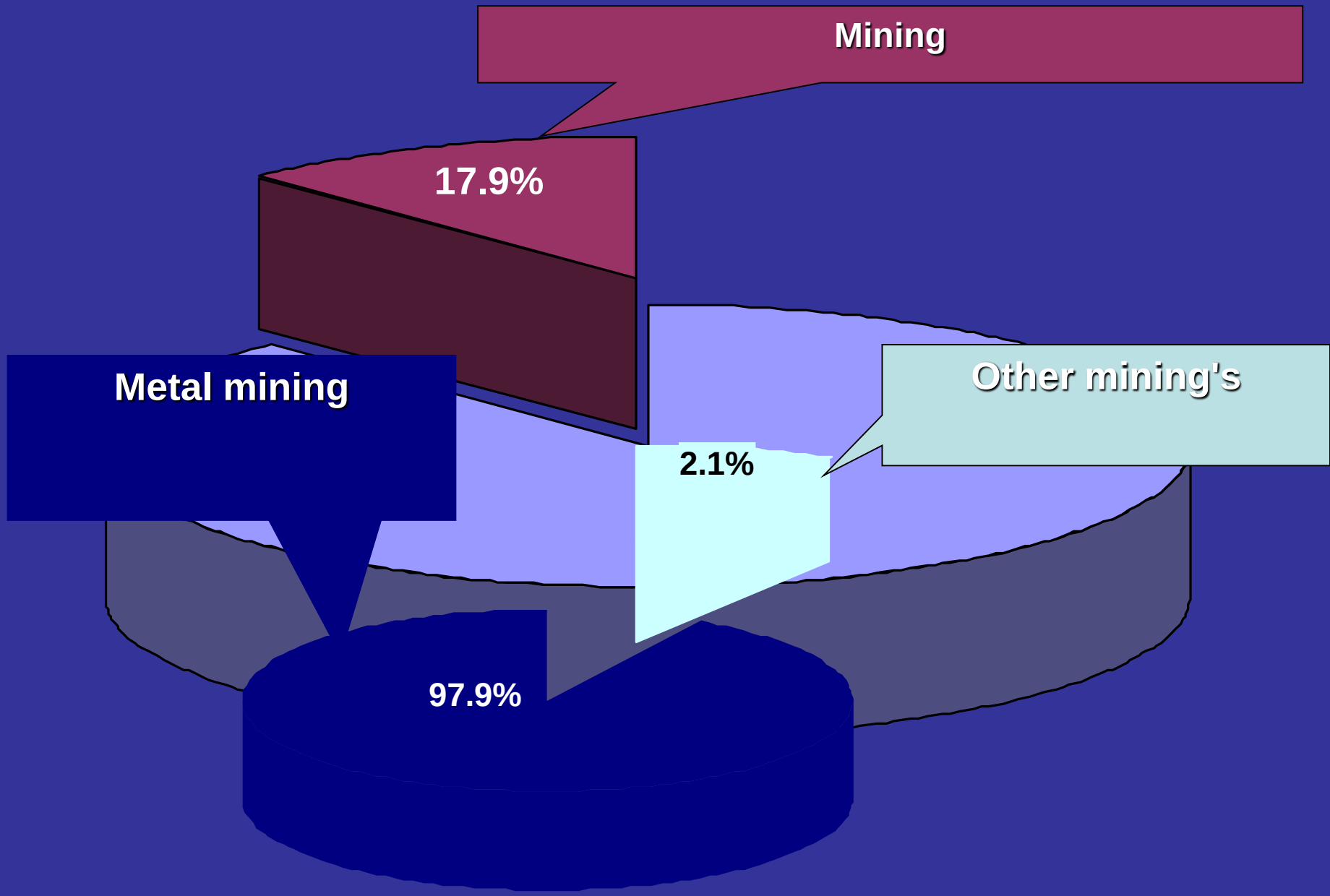
400 deposits are currently exploited

22 of which are metallic

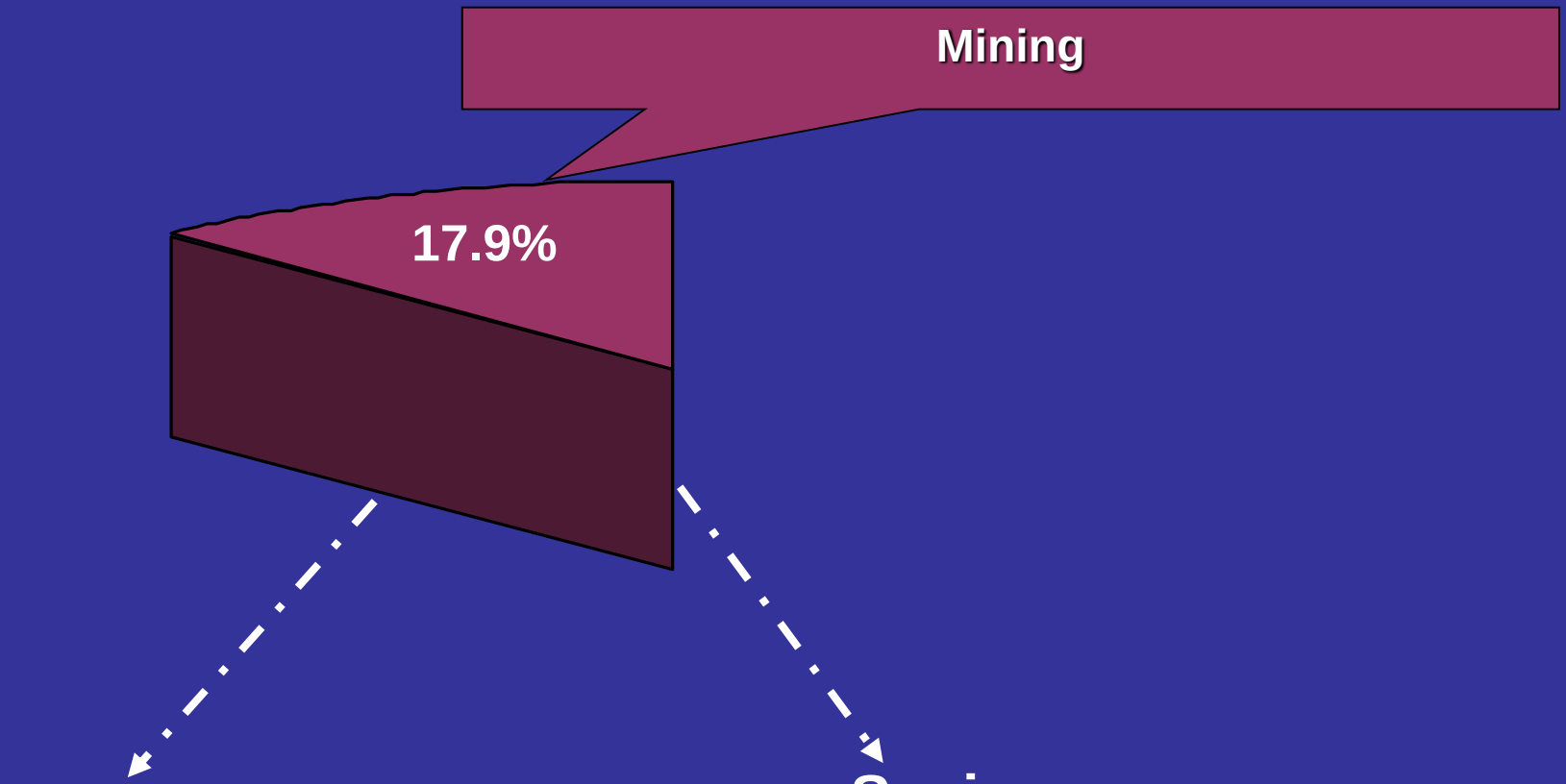
Armenia is rich in

iron,
copper,
molybdenum,
lead,
zinc,
gold,
silver
and rare elements

Share of mining in industry of Armenia



Source` 2017թ. https://www.armstat.am/file/doc/99504393.pdf



Lori marz (province)

26%

Alaverdi,

Akhtala

Syniq marz (province)

65.2%

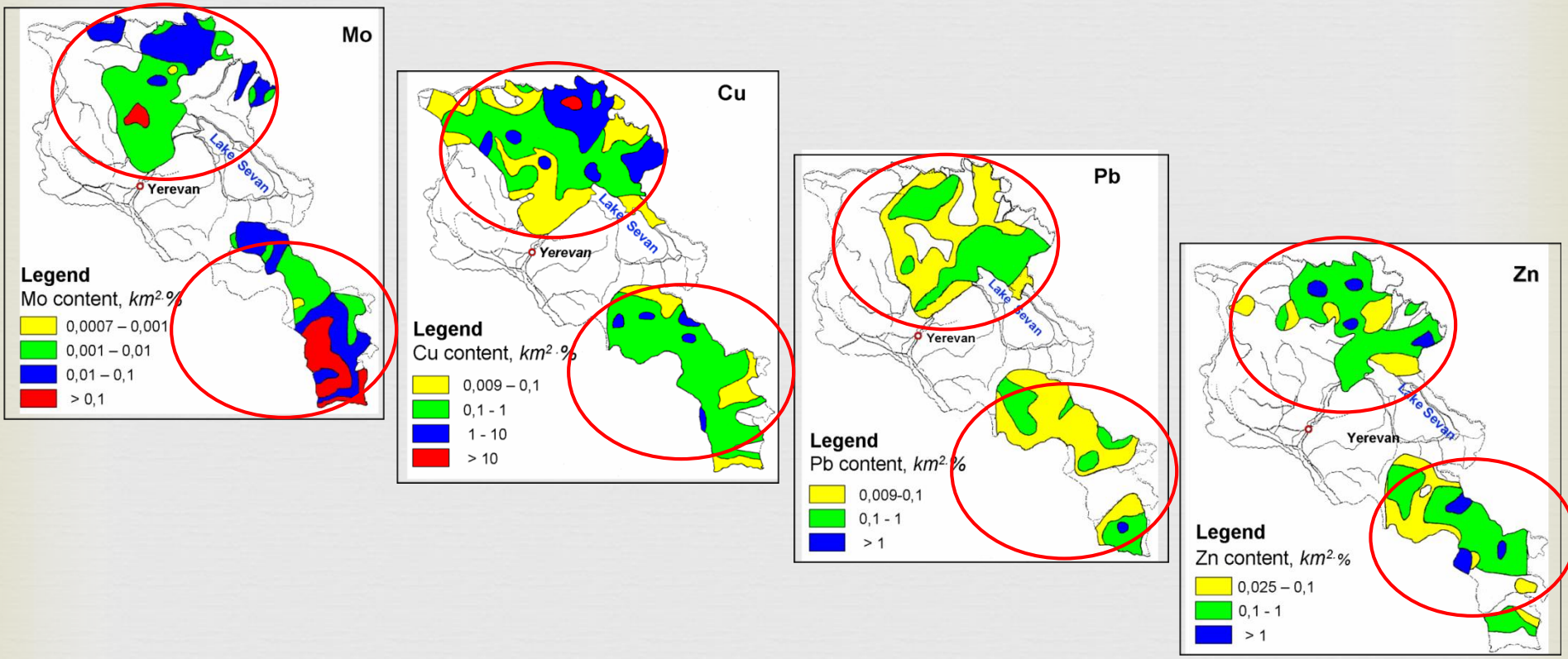
Kapan,

Qajaran

Source` 2009թ. http://www.armstat.am/file/doc/99461598.pdf

Environmental Geochemistry Department

Specialized geochemical schematic maps of Cu Mo, Zn and Pb contents on Armenia's territory (Saghatelyan, 2004)



A schematic map of Summary Index of Pollution (SIP) by heavy metals of Kajaran's soil

LEGEND

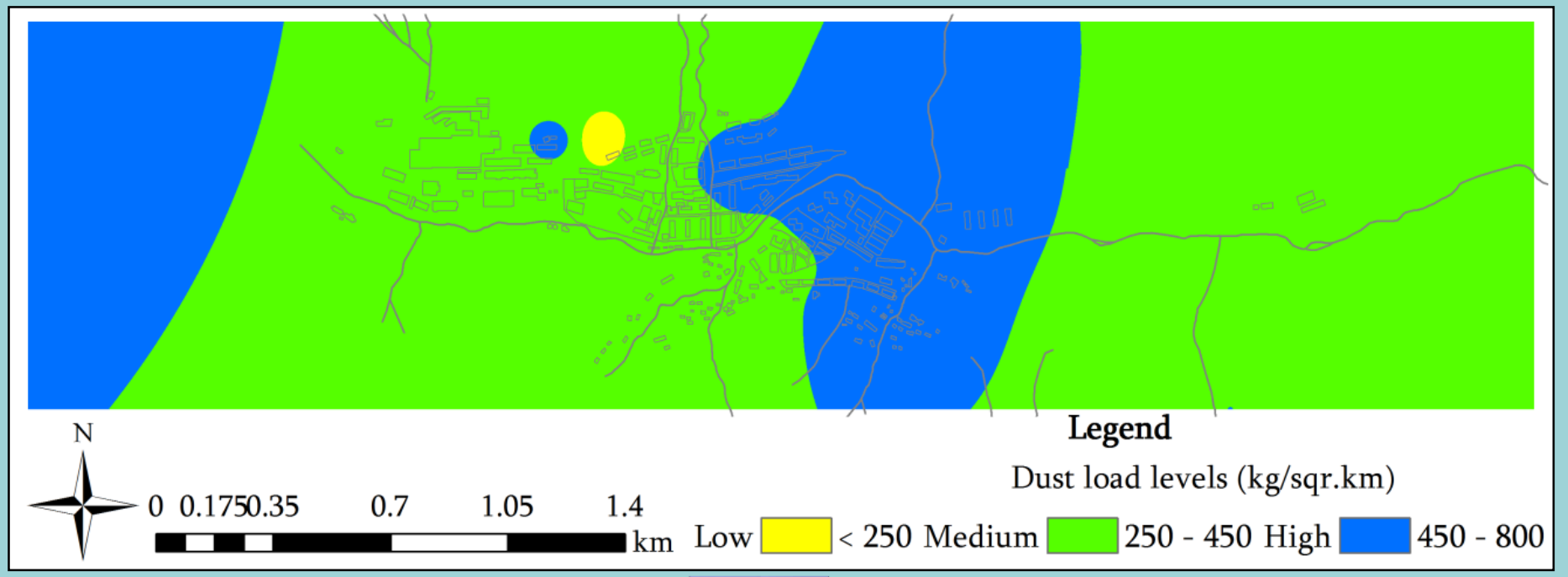
SIP values and pollution levels

I<16	II-16-32	III-32-64	IV-64-128	V->128

Geochemical series: $Mo_{(29.8)}$>$Cu_{(5.1)}$-$Pb_{(2.2)}$-$Co_{(1.7)}$-$Zn_{(1.4)}$-$Mn,V_{(1.2)}$

in brackets excesses vs. background are given

LEAF DUST LOAD LEVELS OF KAJARAN

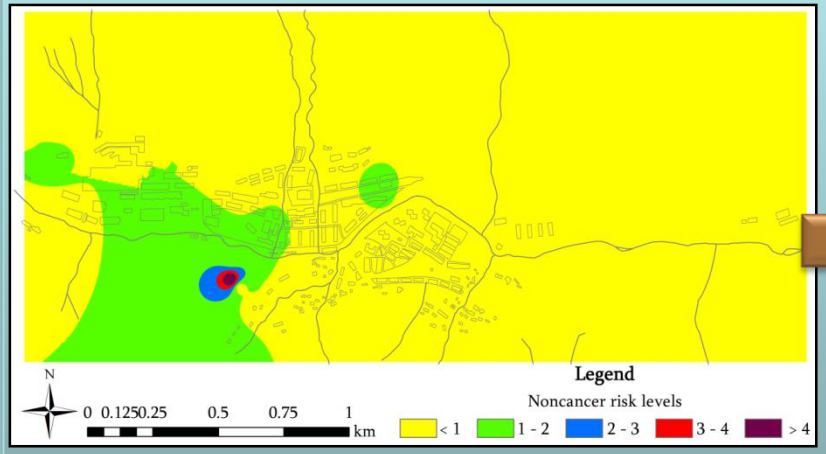


Geochemical series: $Mo_{(7.5)}$-Cu, $Zn_{(4.1)}$-$Ni_{(3.3)}$- $Pb_{(2.6)}$- $Mn_{(1.1)}$

in brackets excesses vs. background are given

RISK ASSESSMENT OF SOILS OF KAJARAN

Non-cancer risk from soils by HI (Hazard Index)



Series of HQ (Hazard Quotient) for each pathway

Mean

Ingestion - $Mo_{(0.24)}$-$Fe_{(0.12)}$-$Co_{(0.09)}$-$Mn_{(0.08)}$-$V_{(0.04)}$-$Pb_{(0.032)}$-$Cu_{(0.027)}$-$Cr_{(0.022)}$-$Zn_{(0.001)}$

Inhalation - $Mn_{(0.019)}$-$Co_{(0.002)}$-$Cr_{(0.0003)}$-$Mo_{(0.00004)}$

Dermal - $Mn_{(0.008)}$-$V_{(0.007)}$-$Cr_{(0.004)}$-$Mo_{(0.001)}$-$Fe_{(0.0005)}$-$Co_{(0.0004)}$-$Pb_{(0.00014)}$-$Cu_{(0.00011)}$-$Zn_{(0.000003)}$

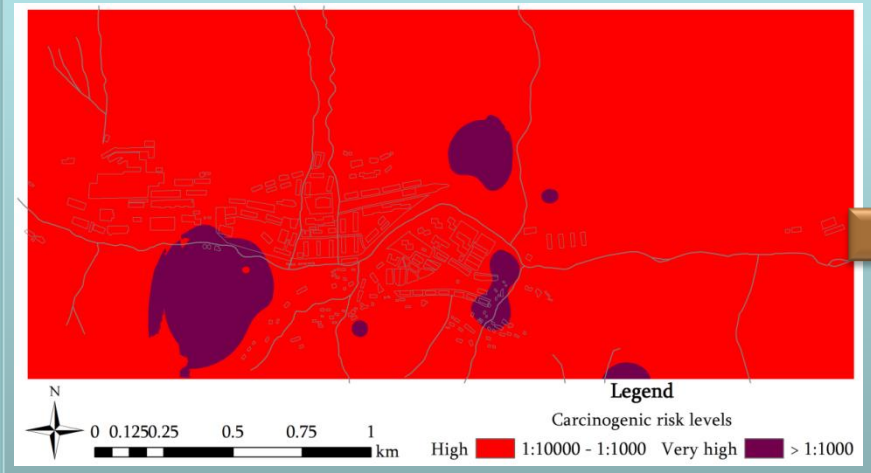
Max

Ingestion - $Mo_{(4.89)}$-$Pb_{(0.93)}$-$Fe_{(0.26)}$-$Co_{(0.18)}$-$Mn_{(0.143)}$-$Cu_{(0.137)}$ -$Cr_{(0.07)}$-$V_{(0.05)}$-$Zn_{(0.003)}$

Inhalation - $Mn_{(0.035)}$-$Co_{(0.005)}$-$Cr_{(0.0011)}$-$Mo_{(0.0007)}$

Dermal - $Mo_{(0.021)}$- $Mn_{(0.015)}$-$Cr_{(0.013)}$-$V_{(0.009)}$-$Pb_{(0.004)}$-$Fe_{(0.0011)}$-$Co_{(0.0008)}$-$Cu_{(0.0006)}$-$Zn_{(0.000014)}$

Carcinogenic risk from soils



Heavy metals used for carcinogenic risk assessment via each pathway

Ingestion - Cr

Inhalation - Cr and Co

Dermal - Cr

Risk Assessment Information System (RAIS, 2016). RAIS Risk Exposure Models for Chemical's, https://rais.ornl.gov/tools/rais_chemical_risk_guide.html

RISK ASSESSMENT OF DUST OF KAJARAN

Noncancer risk from dust

Impute of heavy metals to the mean HI of noncancer risk for each pathway (%)

Ingestion - $Mo_{(0.11)}$-$Pb_{(0.045)}$-$Cr_{(0.036)}$-$Mn_{(0.033)}$-$Cu_{(0.02)}$-$V_{(0.009)}$-$Ni_{(0.008)}$-$Zn_{(0.001)}$

Inhalation - $Mn_{(0.008)}$-$Ni_{(0.0008)}$-$Cr_{(0.0005)}$- $Pb_{(0.0002)}$-$Mo_{(0.000016)}$

Dermal - $Cr_{(0.006)}$-$Mn_{(0.003)}$-$V_{(0.001)}$-$Ni_{(0.0008)}$-$Mo_{(0.0004)}$-$Pb_{(0.0002)}$-$Cu_{(0.0001)}$

HI>1 was not observed

Carcinogenic risk from dust

Heavy metals used for carcinogenic risk assessment via each pathway

Ingestion - Cr

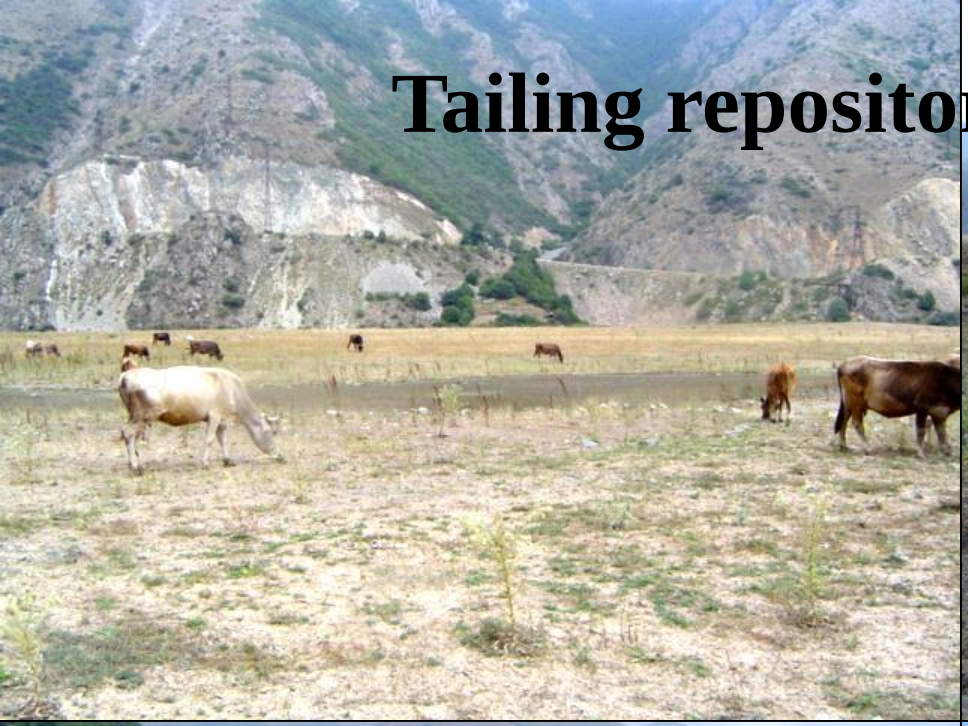
Inhalation - Cr and Ni

Dermal - Cr

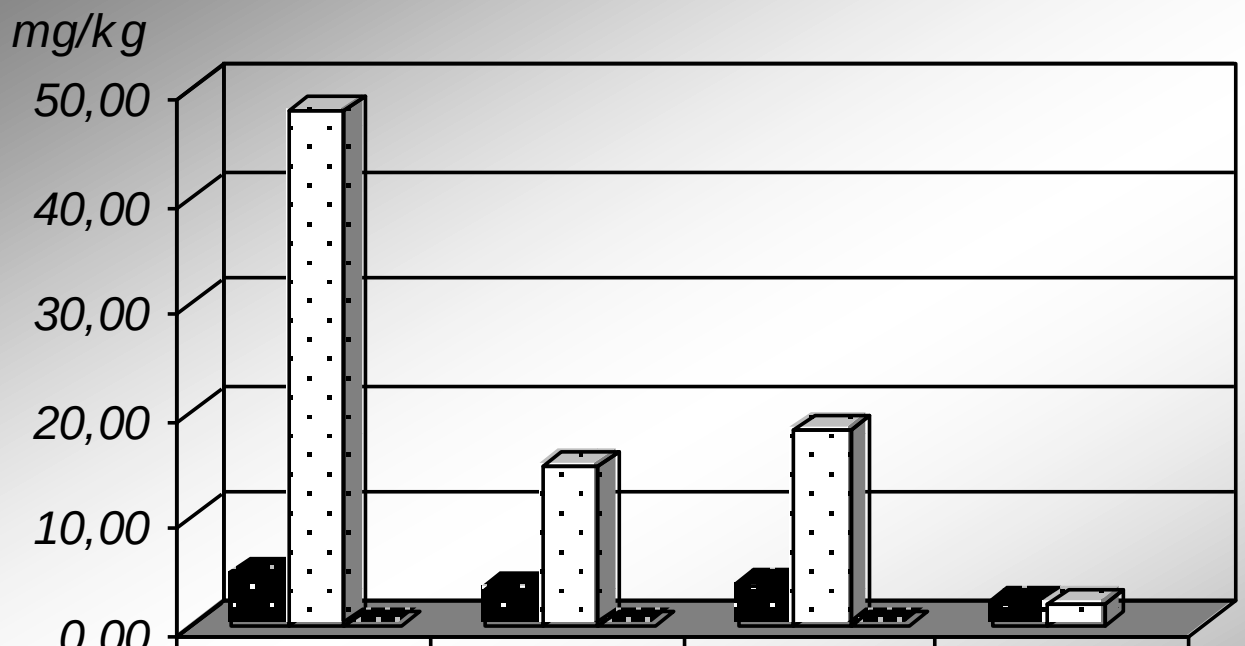
Very high level of carcinogenic risk was observed in all for all samples studied

Risk Assessment Information System (RAIS, 2016). RAIS Risk Exposure Models for Chemical's, https://rais.ornl.gov/tools/rais_chemical_risk_guide.html

Tailing repositories in Kajaran

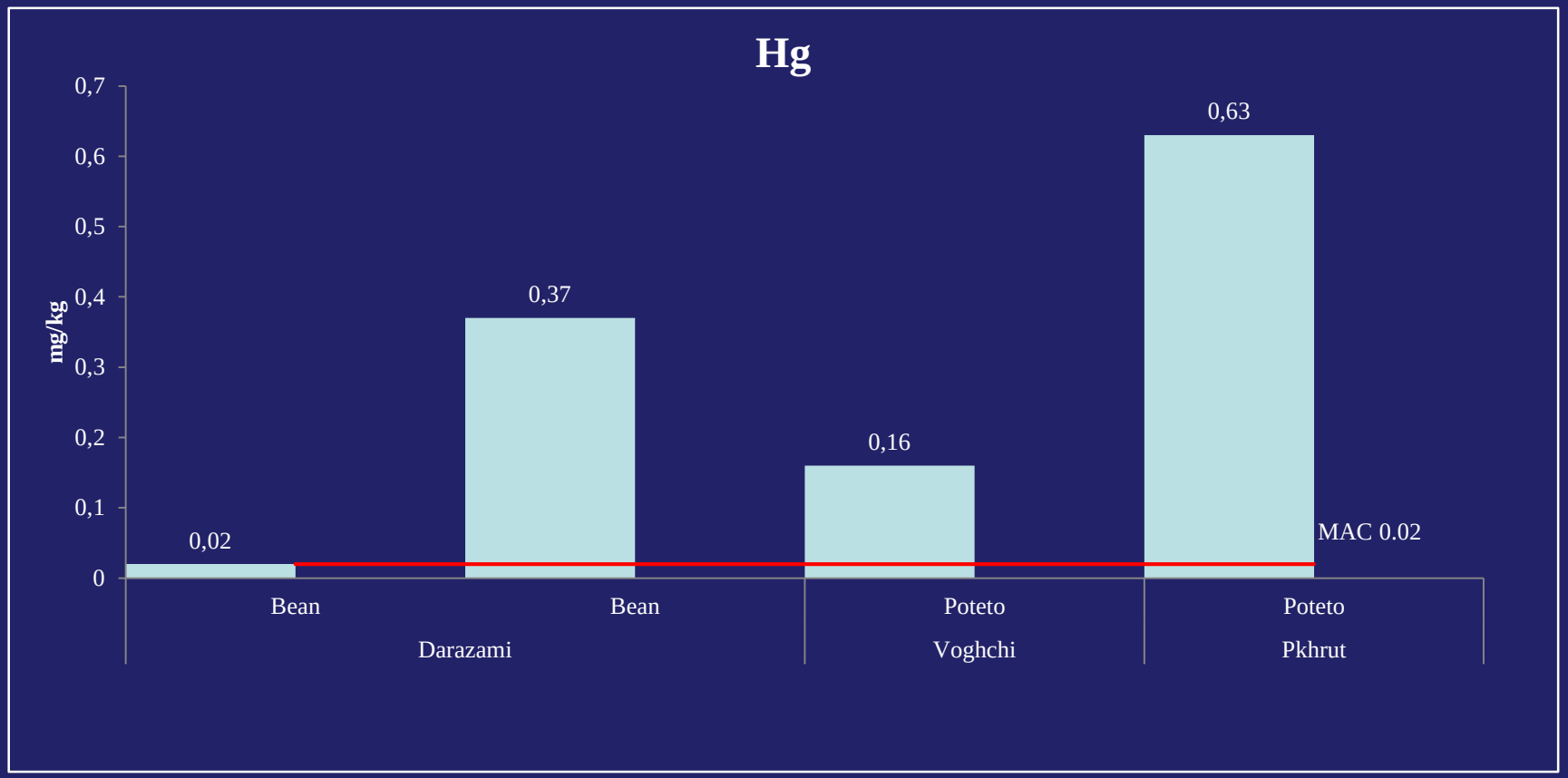


Contents of elements-admixtures in soils and grounds of tailing repositories

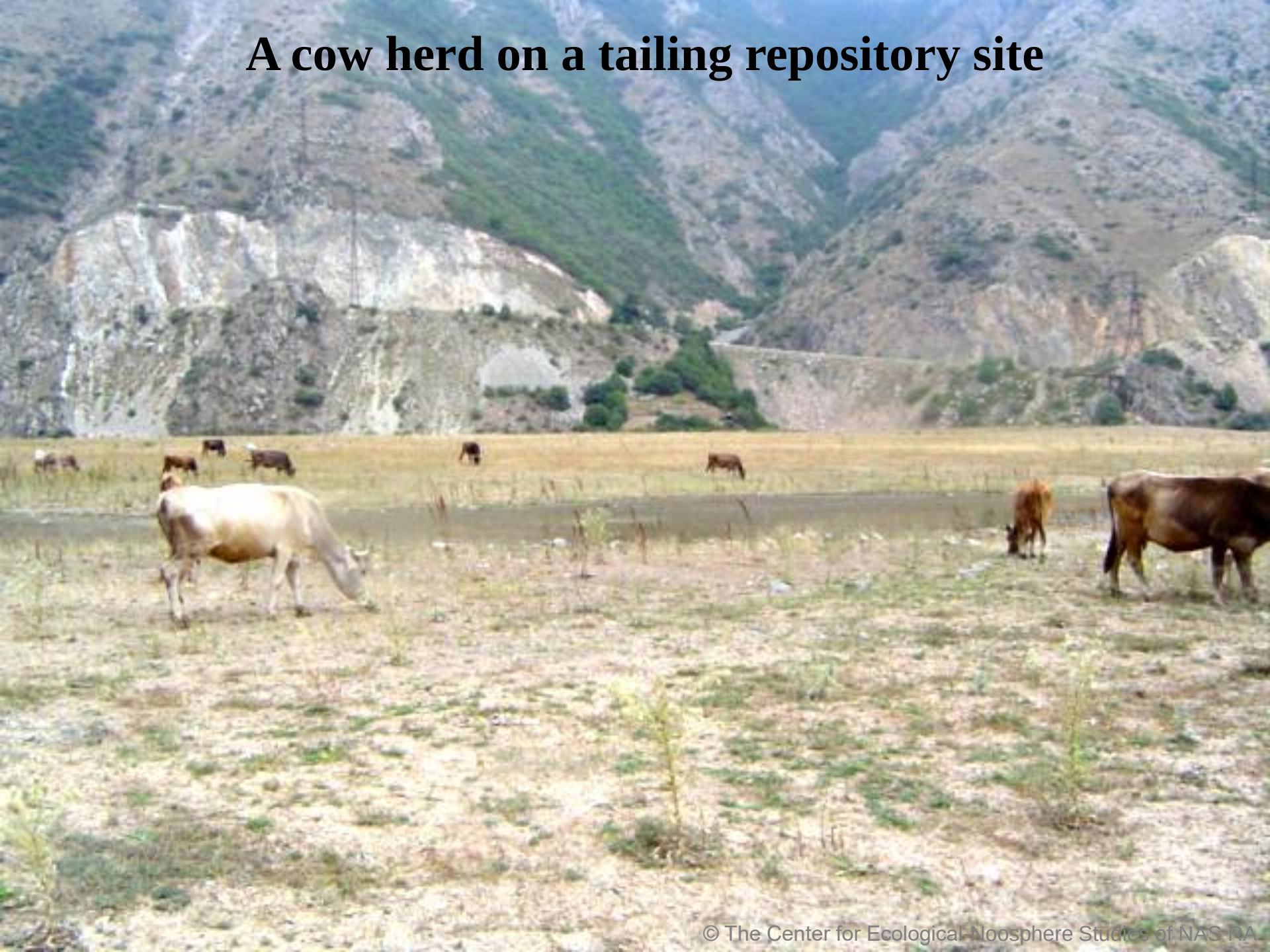


	Pkhrut	Darazami	Voghchi	MAC
Hg	4,80	3,46	3,72	2,10
As	48,03	14,77	18,30	2,00
Cd	0,12	0,07	0,05	

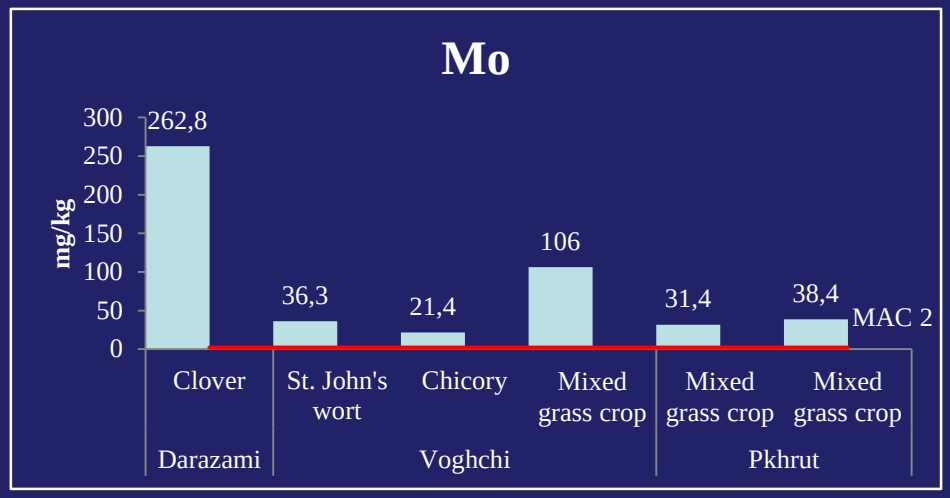
Hg contents (mg/kg) for vegetables grown on the tailing repository sites

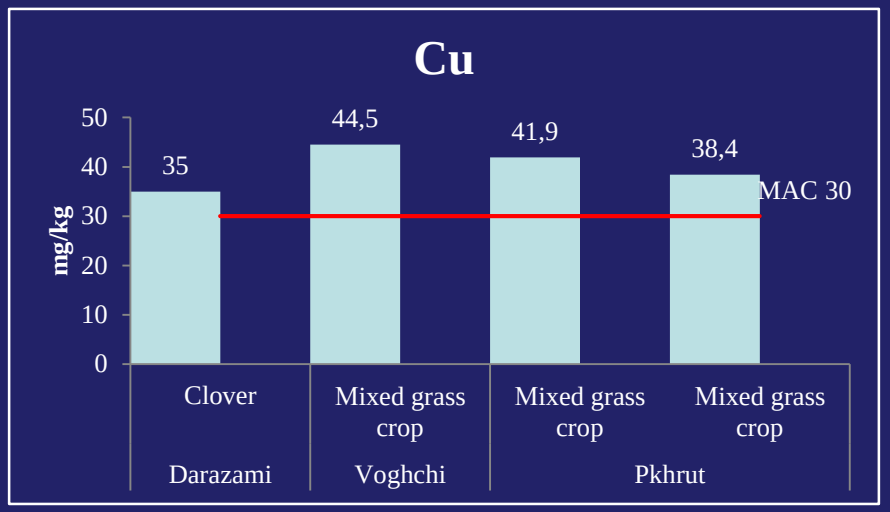


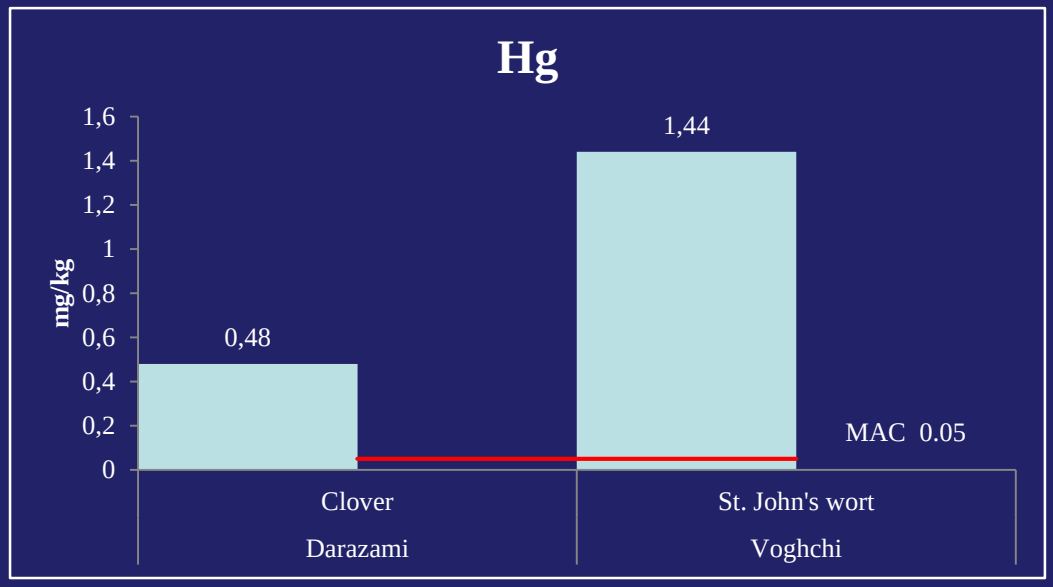
A cow herd on a tailing repository site



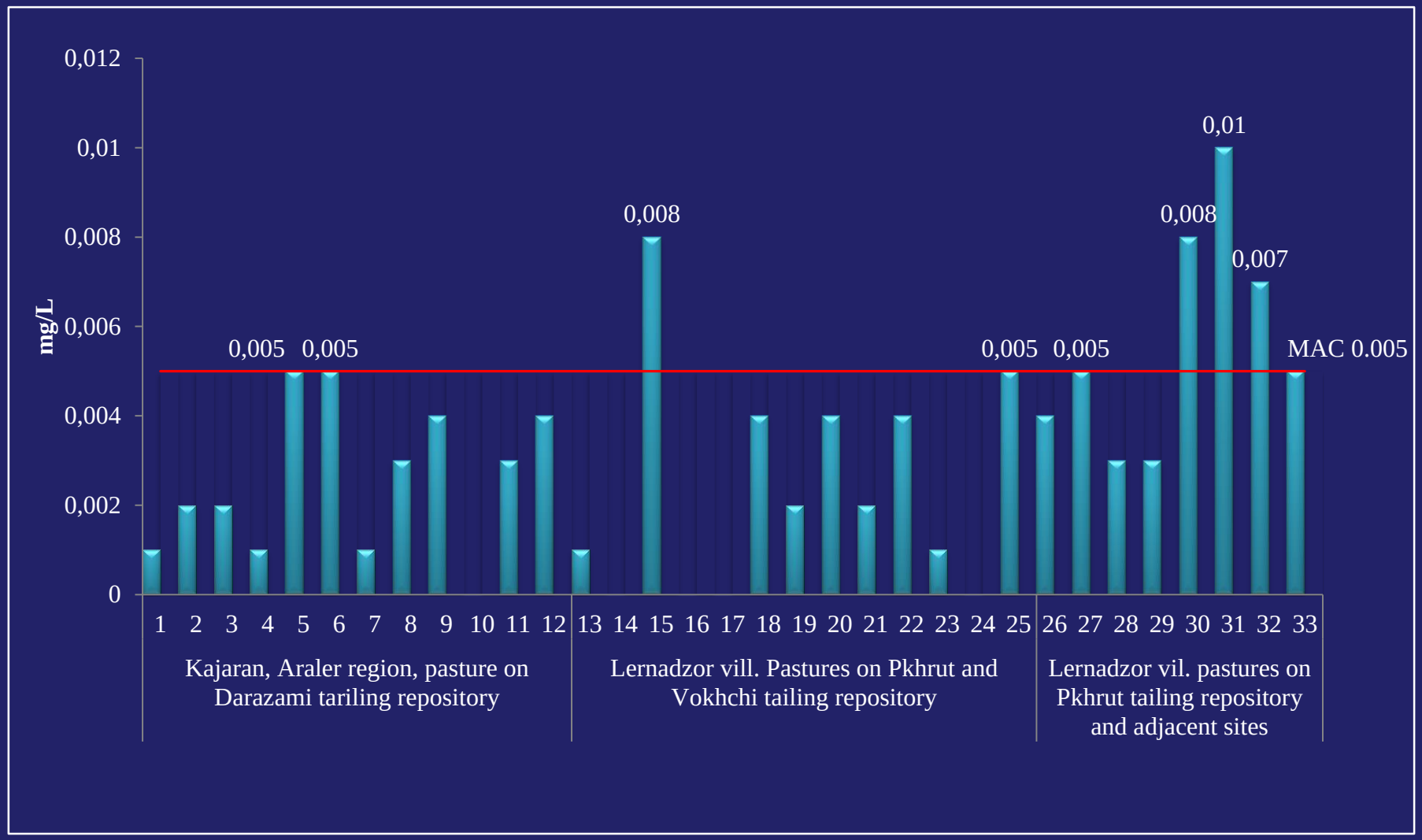
Contents of Mo, Cu and Hg in fodder grasses grown on the tailing repository sites



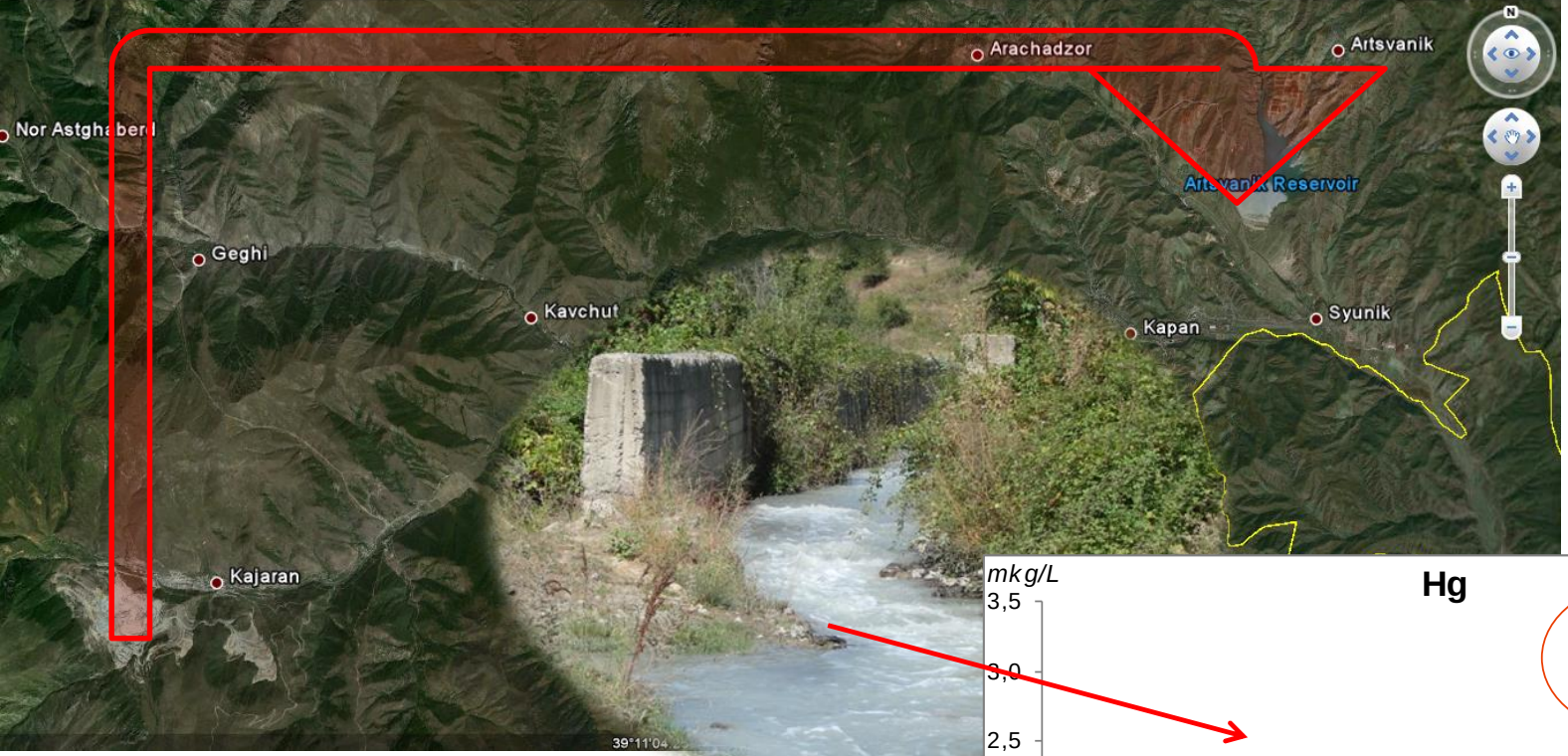




The contents of Hg in fresh milk



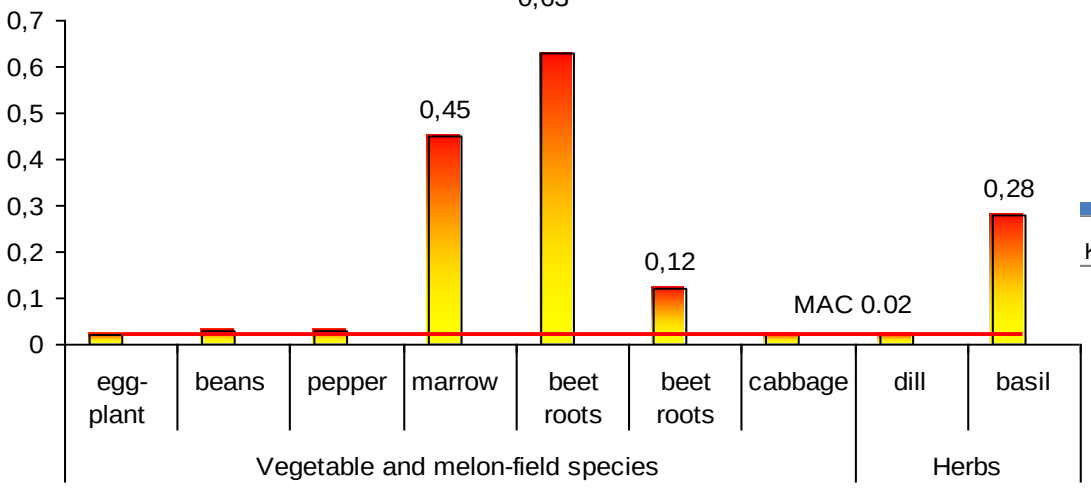
Mine and industrial waters

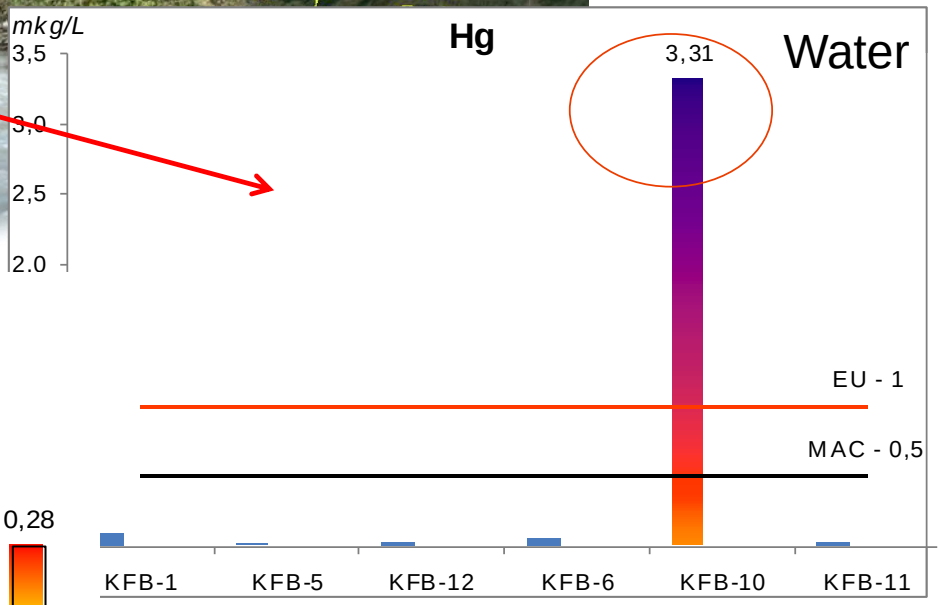


Crops

mg/kg raw matter

Hg

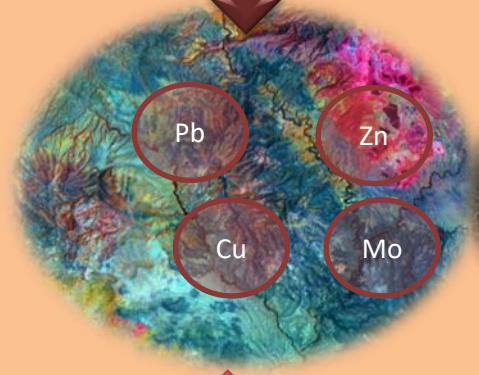




Contamination issues are topical in mining area and is risk factor

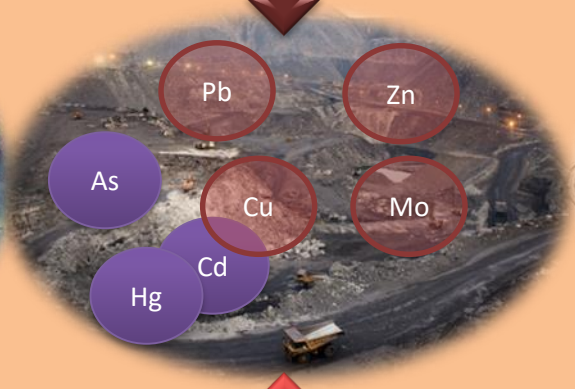
Heavy metals: from mining to human

Biogeochemical provinces



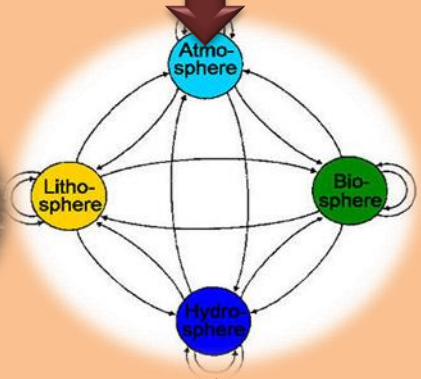
Naturally high in metals

Mining and dressing



Ore + el. admixtures

Pathways



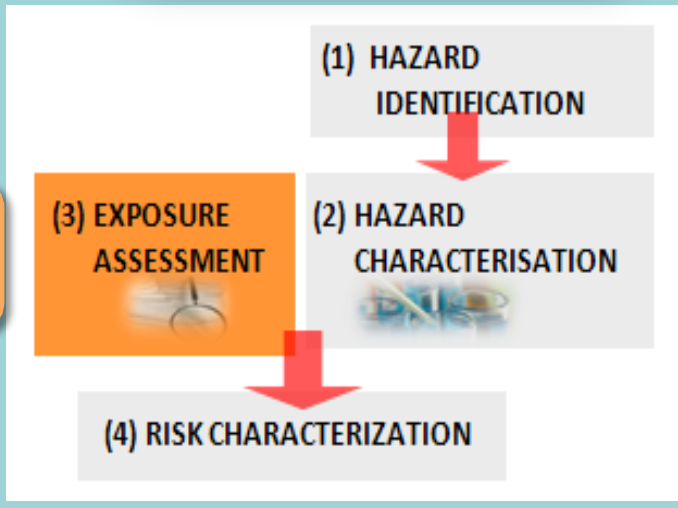
Migration, emission, accumulation

Food chain

Health risk

Human exposure assessment

Chemical Occurrence → **Exposure Assessment** ← **Food consumption**



THANK YOU