



# MITIGATION OF THE HISTORIC POLLUTION IN MACEDONIA

# Hotspots in Macedonia



"The boundaries and names shown on this map do not imply official endorsement or acceptance by the United Nations"

## The former Yugoslav Republic of Macedonia Key Industrial Environmental Polluters and Hot Spots

### Mining Operations

- 1 Rudnici Zetovo Lead & Zinc Mine
- 2 Sasa Lead & Zinc Mine
- 3 Toponica Lead & Zinc Mine
- 4 Radovis Buchim Copper Mine
- 5 Suvodol Lignite Mine
- 6 Osoenje Lignite Mine
- 7 Rchanovo Nickel Mine
- 8 Lojane Chromium & Antimony Mine

### Metallurgical Factories

- 9 HEK Jugohrom (ferroalloy plant)
- 10 MFK Zetovo Lead & Zinc Smelter
- 11 Ferromak (nickel & ferronickel)

### Thermal Power Plants

- 12 REK Bitola (lignite-fired)
- 13 Osoenje (lignite-fired)
- 14 Negotino (oil-fired)

### Other Industrial Plants or Sites

- 15 Hartija AD Paper Processing Plant
- 16 MFK Zetovo Fertiliser Plant
- 17 Zastava AGP Car Components Plant
- 18 Tetikva Textile Plant
- 19 Silika Alumina (Karat) AD Fireproof Materials Plant
- 20 Driksa Landfill
- 21 Tase Caleski Metal Resurfacing Factory

The majority of the industrial "polluters" are situated in Skopje

- Alkaloid AD Pharmaceutical Producer
- Bakery "S Marf"
- Clinical Center Heating Plant
- District Heating Plants (East, West, 11 October, Park & Vadno)
- Evropa Chocolate Factory
- Good Leather Plant
- Iron & Steel Plants: "Balkan Steel", "Toponica AD" & Makedni
- Makedni Steel Plant
- CHS AD (Organic) Chemical Complex
- CIKTA Oil Refinery
- Pivara Brewery
- AD TIPO Clay & Ceramic Plant
- RZ Toponica AD Ferro-Alloy Producer
- USJE Cement Plant

Source: Ministry of Environment and Physical Planning and UNEP.



# Bucim mine – water pollution

Waste rocks dump like other Bucim structures created by mining operations is among the most prominent artificial structures in the Eastern Part of Macedonia. The total area covered with waste rock dump is 152,6 ha and it contains more the 110.000.000 tons of waste rocks including highly leachable oxide minerals.



The drainage from the dump is very acidic  $\text{pH} < 3$  and contains 200 – 400 ppm Cu (clearly visible blue/green tint). Acid drainage is of particular importance due to the longevity of its impacts. Those waters are drained in Topolnica River making the water from the river very dangerous source of pollution for downstream surface waters.

# Bucim mine – air pollution

Flotation tailings dump with over 100,000,000 tons solid residuals from the flotation process (containing remains of Cu, As, Ni and other HM minerals). The dam body volume totals 60,000,000 m<sup>3</sup>.

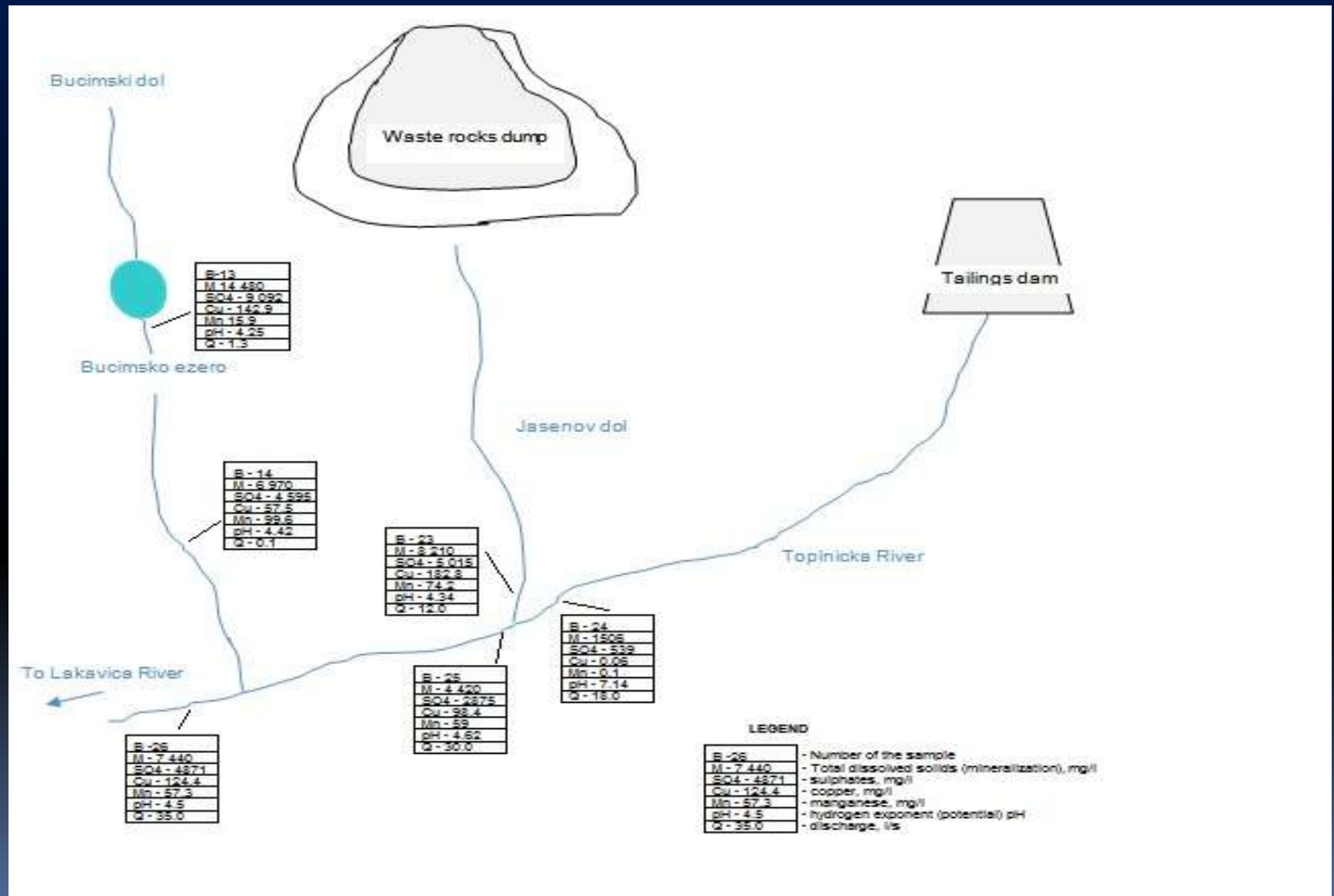


Clouds of fugitive dust emanated from the open dam crest (total surface of approx. 20 ha) and dry beaches, directly endangering inhabitants of Topolnica village posing high respiratory illnesses risks and nuisances. These fine dust particles also reach nearby agricultural fields.

# Bucim Mine - Pollution mitigation objectives

1. Design and build a system for collection and treatment of the waters from the mining zone, the tailing pond and the waste-rock dump, thus eliminating downstream pollution;
2. Design and put in place air pollution prevention systems by establishing vegetative cover on additional 20 ha at the tailings dam and improvement of the irrigation system for vegetative cover and watering the uncultivated areas.

# Bucim mine – surface water pollution









# Fugitive dust control – tailings dam Bucim



# Lojane mine

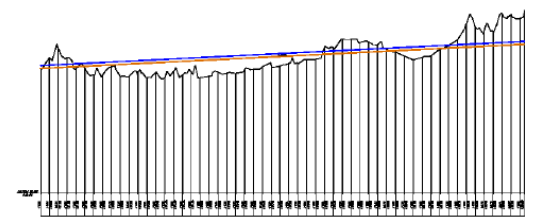
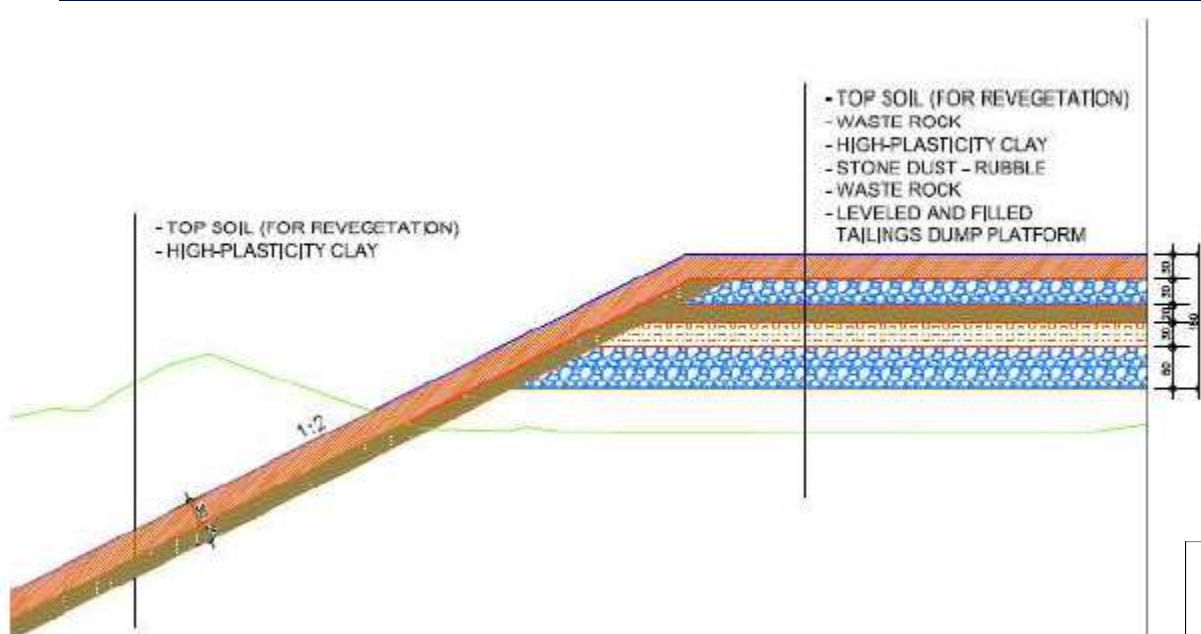


# Lojane mine, Lipkovo municipality

- Lojane, Chromium and Antimony Beneficiation Plant - abandoned Mine (operated from 1923 to 1979)
- The most affected area is between the villages Lojane, Vaksince and Tabanovce.
- Sources of contamination with heavy and toxic metals (As, Hg, Cr<sup>6+</sup>, Sb).



# Lojane mine



|  |             | GTI - GEOTEHNIČKI INŽENJERING   |            |             |            |             |  |            |             |            |             |            |             |  |
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 Projekt: Tehnični načrt za sanacijo   dejavnosti - LOJANE VARNI PVO ŽAR | || 1:100/1000 | Drawing | LONGITUDINAL PROFILE | Drawing | 1/1 |







## Capacity building activities

- Training program on Environmental Impact Assessment and Integrated Pollution Prevention and Control (IPPC) for all 85 municipalities in Macedonia. A series of three one-week training sessions for local government staff have taken place between Dec. 2009 and Feb. 2010
- Training for enhancing technical and management capacities of mining operators about the Environmental Management Standard ISO 14001, and Occupational Health And Safety Management Systems OHSAS 18001, as well as the main requirements for introducing Environmental Management System (EMS). Two separate series of workshops have been organized for the mining companies in western and eastern parts of Macedonia.

## Capacity building

- Training program was conducted to strengthen the technical and management capacity of mining operators by their exposure to the principles of Cleaner Production Concept and Preventive Integrated Environmental Strategy for the Entire Production Cycle. Comprehensive training materials and guidelines have been developed. The introductory five days Cleaner Production Training Course for two groups of 5 to 10 mine operator representatives from the mining facilities in Eastern and western Macedonia have been successfully completed.
- Technical support to MoEPP for Environmental Liability Legislative Assessment and Capacity Building. This technical assistance assignment will strengthen the capacities of the relevant national authorities in the areas of: (a) environmental damage regulations (damage to species and habitats, water and human health) including the most appropriate remediation measures and (b) regulations on the management of waste from extractive industries.

## Public awareness

- RESEARCH on state of environmental public awareness (Municipality of Lipkovo and Radovish)
- Surveyed focus groups
  - Education
  - Primary Health care givers
  - Local Self Government
  - Business sector
  - Civil Societies

## Public awareness

- Training on environmental education for teachers and professors
- Training for primary care givers on health risks
- Training on initiatives and campaigns
- Study tour on Hot Spot sites for journalist and students of journalism
- Training for environmental investigative reporting (national and local media)
- Organized Forum and Debates in the local communities
- Additional project promotion activities (8<sup>th</sup> annual meeting of environmental organization from Macedonia)

# Policy & institutional accomplishments

- Set an example for:
  - Public-Private Partnership (Bucim Mine) – cost sharing
  - Cooperation national – local
  - Developed high-quality, state-of-the-art remediation technical designs
- Promoted regional cooperation & exchange of experience
  - National level
  - Expert community
  - Study Tours organized - comparison of practices in the wider region;
- Strengthened capacity @ national & local level
- Set the stage for further national, regional & development cooperation projects on Hot Spots / Brownfields