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Toxic Mining Waste in the pre-Accession Countries

the pecomines project

Concepts to Link Inventory, Impact Assessment and Legislation Development

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Institute of Environment and Sustainability
Soil and Waste Unit

NATO/CCMS STUDY PILOT MEETING
Baia Mare, Romania, September 8 -11, 2003.

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Rationale: Why Mining?

Potential environmental risks

- **Safety of waste facilities (in particular dam stability)**
- **Operational waste management (acid mine drainage, possible contamination of the environment)**

Commitment of the European Commission for a Directive on Mining Waste

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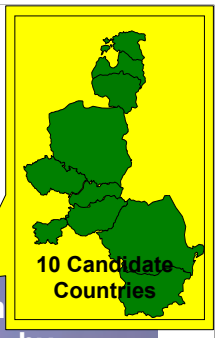
A Research Project Focusing on Inventory, Regulations and Environmental Impacts of Toxic Mining Wastes



Objective 1: Contribute to the assessment of consequences of mining accidents in perspective of ecosystem protection, by comparing approaches to site monitoring and restoration

Objective 2: Develop a methodology for inventory of toxic waste sites from mineral mining in relation to "sensitive" catchment areas, by combining an indicator approach and an analysis of satellite remote sensing

Objective 3: Comparison of existing legislation on mining and mining waste to support the environmental approximation process

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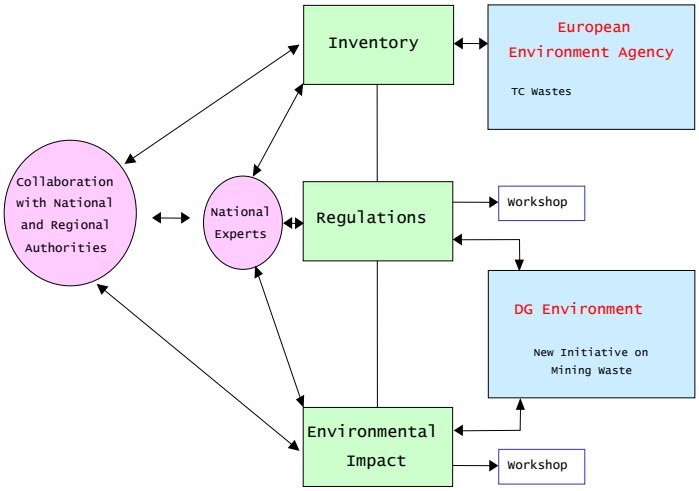
pecominesproject structure



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*pecomines*state-of-play





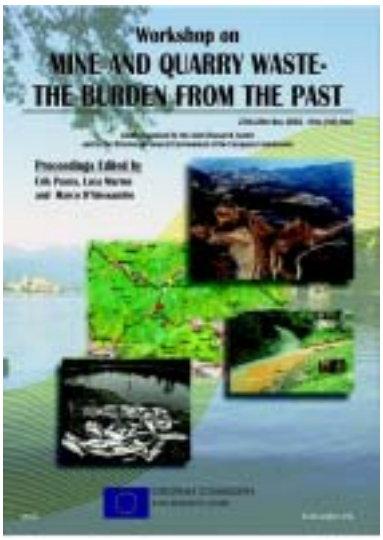


Guidance through a Steering Committee:

- Reference in each country to assure scientific quality and relevance of the project in the light of needs of Candidate Countries.
- Organisation of Meetings and Workshops (October 2001, May 2002, autumn 2003) involving also UNEP, Euromines, WWF, MS, DG ENV, EEA.

Spin-off Project:

- Joint field campaign MAFI, VITUKI, ITC, JRC-IES and DLR for data acquisition at two Hungarian mining areas in conjunction with HySense flight (August 2002).



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Work Packages in the DPSIR Framework

DRIVING FORCES

human demand for mineral resources

inventory

PRESSURES

emission sources as the result of exploitation of mineral resources and abandoned mining areas

assessment

STATE

the quality of environment threatened by emissions originating from mining

IMPACTS

degradation of ecosystems, quality of life, including human health, cultural resources, recreational value

regulation

RESPONSE

actions of communities and policy makers to reduce impacts and risks to an acceptable level

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PRESSURES

THE INVENTORY APPROACH

inventory







Develop and test a methodology to gather data on potentially hazardous mining waste sites on a country basis. The approach combines site-specific information harmonised through a **questionnaire** and put into a relational **database**, with geo-referenced spatial information also derived from **remote sensing** data.

- **Expert network,** communication with national experts responsible for data supply which ensures efficiency and ***quality control***.
- **Digital interface, web application** for data presentation, dissemination and inquiry through Internet was developed. All questionnaire ***data***, spatial data (***maps***, etc.), other information e.g. ***text***, ***graphs*** and ***photos***.
- **Detailed guide, glossary and Questionnaire.**
- **Data need kept to the minimum** necessary for site screening.
- **Hierarchical data structure** from basic (location, status, commodity) to more complex and uncertain information (waste quantities, emissions). In this way the Questionnaire is suitable for both ***regional screening*** and ***detailed local inventory*** of mine waste source characterisation.

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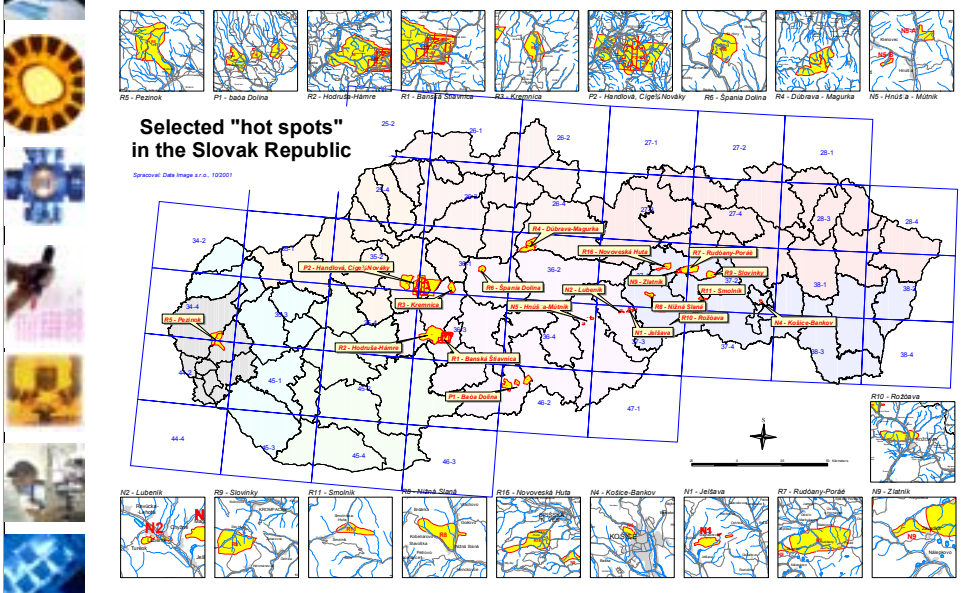
Inventory Example: Slovakia



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Areas of intensive mining and processing waste ("hot spots") in Poland

MINING BRANCH	Area	NUMBER OF MINES	Extracted matter Gg	Number of disposals	DISPOSAL AREA thous. m^2	Waste quantity Gg	Annual Extraction Gg/a	Hazardous component
Hard coal	Upper Silesian Coal Basin	27	102 480.0	49	20 551.0[1)]	441 441[1)]	90 881.2[2)]	NaCl - 1.76 %; FeS_2
	Rybnik Coal District	15		14	6 202.0	252 625.0	50 750.8[2)]	NaCl - 1.76 %; FeS_2
	Lower Silesian Coal Basin	-	-	4	2 730.0	74 248.0	-	FeS_2
Lignite	Kleszczów Trough	2	34 664.0	2	3 080.0	14 000.0	4 109,0[3)]	Na_2^+, SO_4^{2-}, Pb, Cr, La
	Zittau Depression	1	9 177.0	1	887.5	no	3 456.0[3)]	Na_2^+ - 2,72 %, Hg, Cr, Cu, Sr, V, Co, Ni
	Konin District	9	15 700.0	2	4 320,0	29 400.0	1 339.0[3)]	Na_2^+ - 0.60 %, SO_4^{2-} - 11.75 %, Sr, Cr
Radioactive elements	Kowary Area	-	-	10	168.5	4 710.0	-	UO_2 - 0.15 %; 0.1-0.4 µGy/h
	Radoniów Area	-	-	3	no	520.0	-	no
Copper ore	Lubin-Głogów Copper District	4	27 142.0	2	14 500.0	71 844.0	19 688.0	Cu - 0.17 %
	Grodziec Depression	-	-	3	3 860.0	40 380.0	-	Cu - 0.20 %
	Złotoryja District	-	-	2	no	21 854.1	-	no
Zinc/lead ore	Bytom Area	-	-	23	5 492.0	15.861.0	-	Zn - 2.47 %, Pb - 0.38 %
	Chrzanów Area	2	-	3	742.0	13 200.0	1 004.0	Zn - 1.02 %, Pb - 0.36 %
	Olkusz Area	3	41 200.0	3	1 040.0	24 401.9	2 007.7	Zn - 0.85 %, Pb - 0.38 %
Nickel ore	Ząbkowice Śląskie Area	-	-	7	591.2	11 030.0	-	Ni - 0.35 %
Arsenic ore	Złoty Stok Area	-	-	2	no	100.0	-	As
Sulphur	Tarnobrzeg Area	3	940.0	1	5 237.5	1 540.6	208.0[4)]	H_2S, SO_2; in "kek" S – 44.0 %

PL-Geological Survey

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Inventory Example: Hungary

H-Ministry of Environment

Landscape Wounds (incl. mining sites)

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PRESSURES

inventory







pecomines database: Web application

mining site in the database

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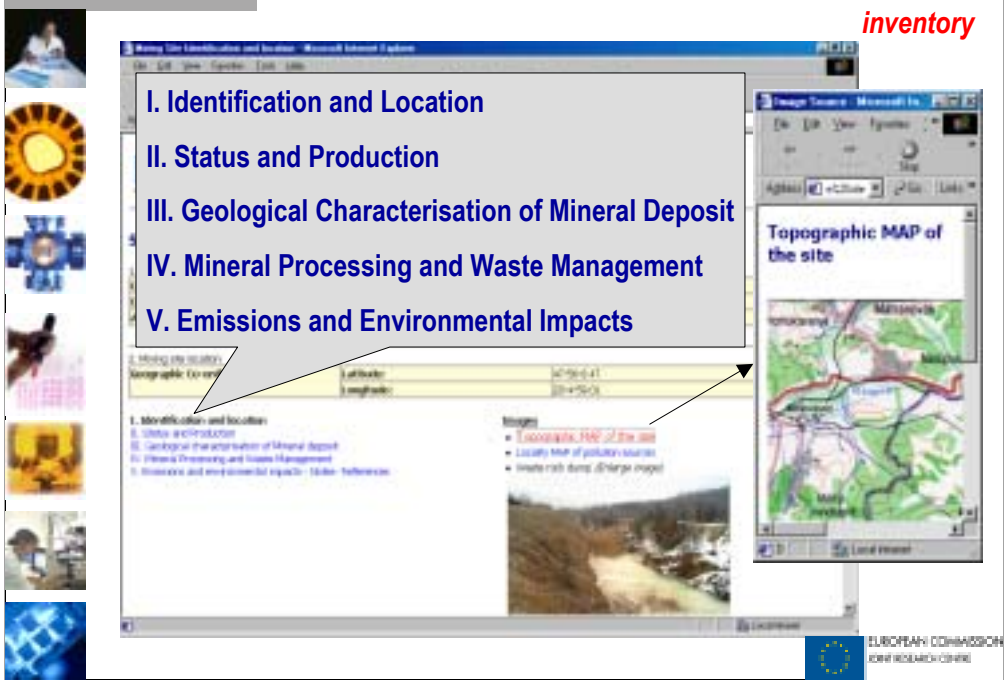
PRESSURES

inventory



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The Remote Sensing Component

Support compilation of the inventory by improving spatial details and differentiation of potentially hazardous mining waste materials from other sites in the CORINE LC system. A geo-referenced mapping of surface mining waste deposits at local and national scale, based on spectral discrimination of mineralogical components. Demonstration of the method applied to Landsat-TM data for rapid screening.

SLOVAKIA

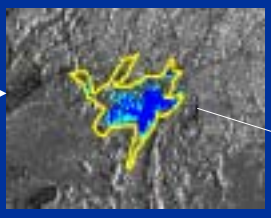
ROMANIA

Multi-temporal satellite scenes at time intervals covering the period 1985 – 2000. Total area covered is ca. 120 000 km^2.

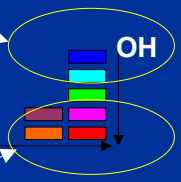
SPECTRALLY BASED METHODOLOGY FOR RAPID SCREENING OF MINING WASTES BY USE OF LANDSAT-TM IMAGES

Exposed rock surface:
Andesite quarry-*RO*

Strong weathering of iron oxides and hydroxides

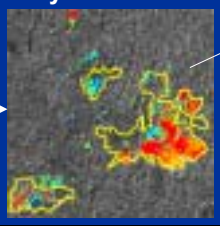


Processed remote sensing image pointing out ferric/ferrous minerals



Secondary minerals in sulfide bearing deposits:
Porphyry copper open-pit

Oxidation of sulfides with release of acid water and heavy metals



Processed remote sensing image pointing out co-occurrence of both OH and Fe bearing minerals

Output: large-area maps of spatial distribution of mining wastes

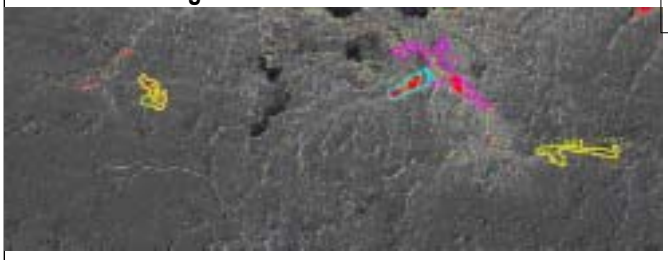
Discrimination between weathered materials and others prone to acidification

Detection of changes over time

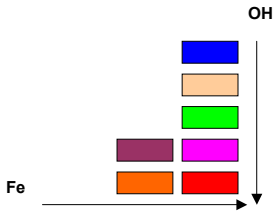
Landsat-TM image (07.10.1991)

Map of mineral fuels and metals

Processed image showing the zones with iron oxides and OH-bearing minerals



Novoveska Huta – Rudnany (Slovakia)



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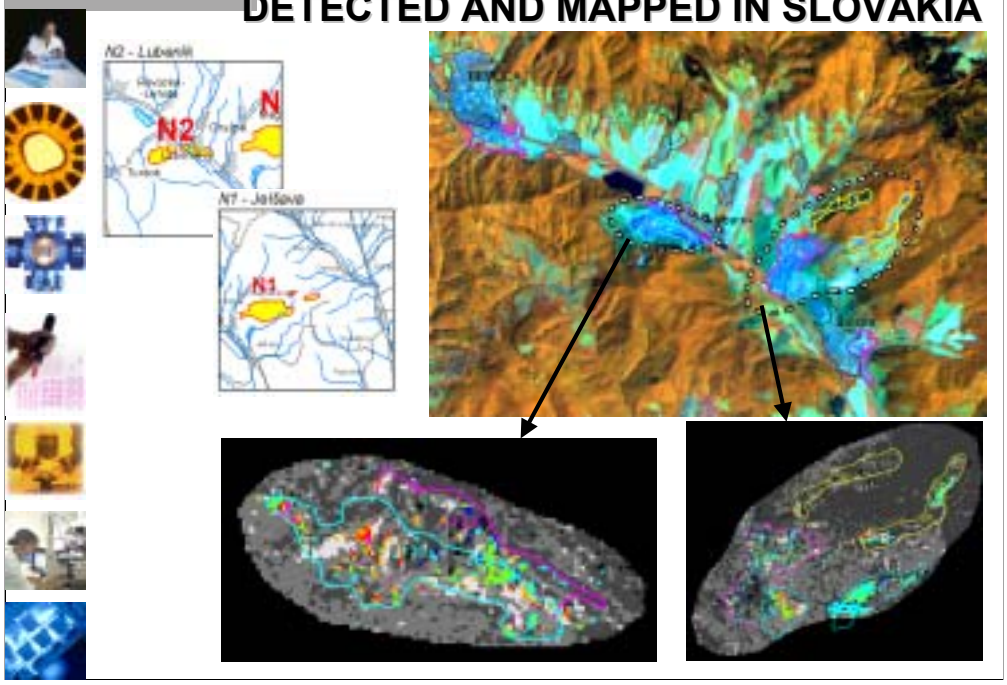
REMOTE SENSING ANOMALIES DETECTED AND MAPPED IN SLOVAKIA



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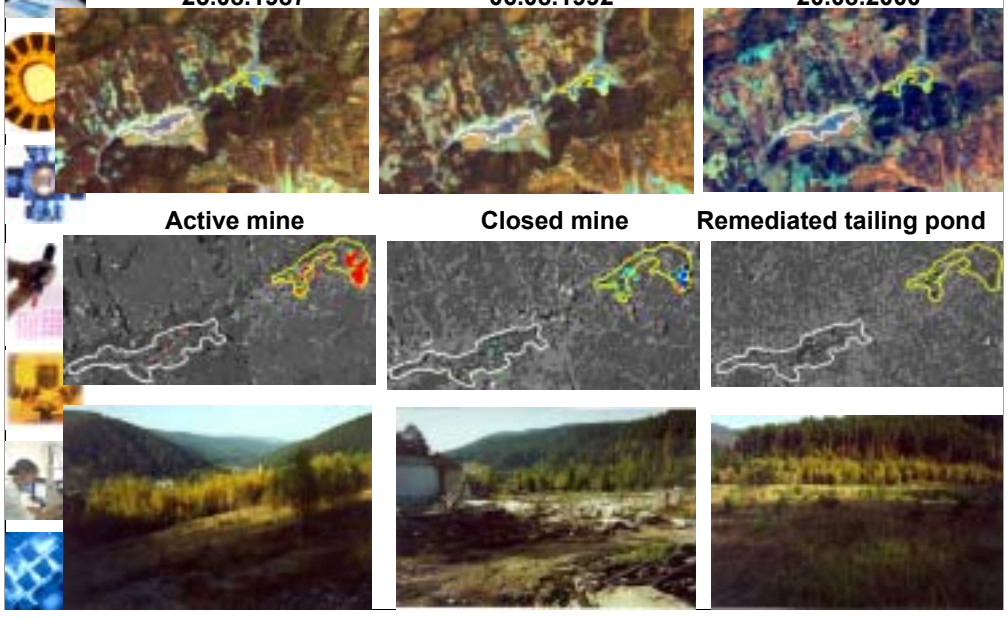
Change detection in Smolnik – Smolnicka Huta area, Slovak Republic



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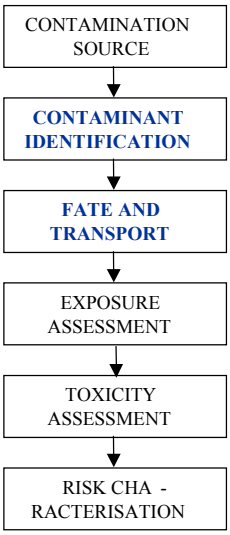
STATE AND IMPACTS

Actions on multi-country level require harmonised criteria and procedures to classify environmental impacts.

A comparative assessment and ranking of different mining sites for 37 hot-spots focusing on initial steps of the overall risk assesment. The hot-spot (metal, uranium, fossil fuel, industrial minerals) categories are:

1. Sites emitting hazardous, polluted water
2. Large contaminated lands, waste heaps and/or tailing ponds
3. Tailing ponds with large volumes of polluted water or heaps with unstable slopes, at risk of accidental release of pollutants

assessment



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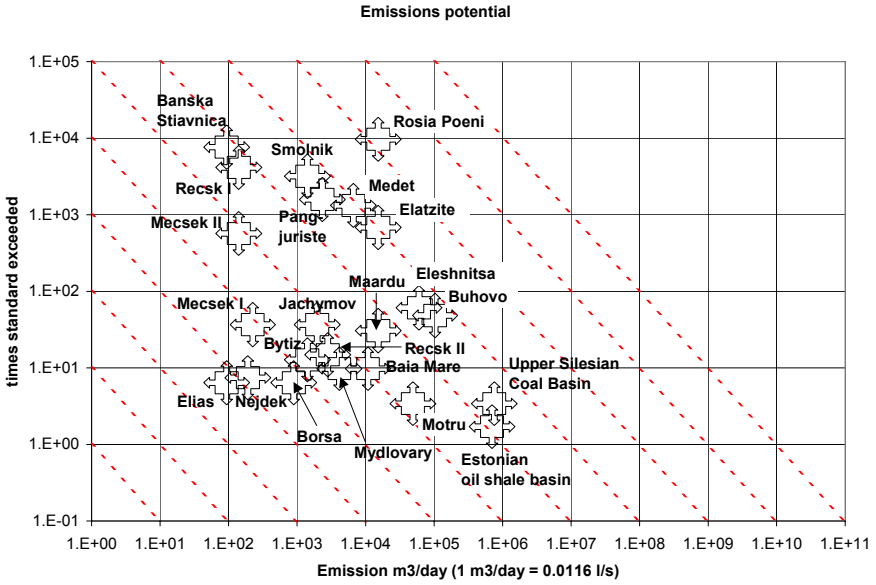
... and application to other sites, which are compared on log-log scale plotting emission flow-rates and the number of times environmental quality standards are exceeded.



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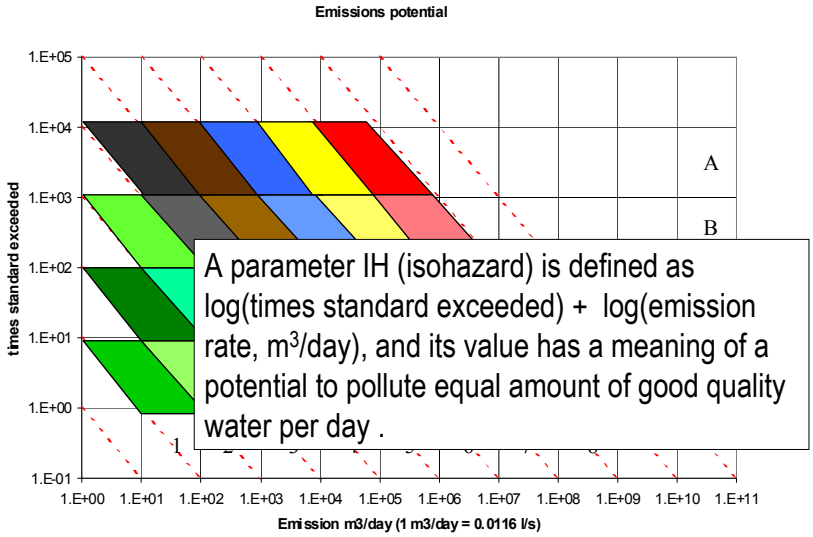
Possible classification of hazardous sites with respect to the emissions potential.



A parameter IH (isohazard) is defined as log(times standard exceeded) + log(emission rate, m^3/day), and its value has a meaning of a potential to pollute equal amount of good quality water per day .

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RESPONSE

regulations

The approach addressed and clarified:

- Ownership (land, minerals, waste)
- Authority framework, licensing procedures
- Control, sanctions, liability
- Financial aspects and public acceptance
- National policies, programmes
- Data management and access
- Original regulatory ideas

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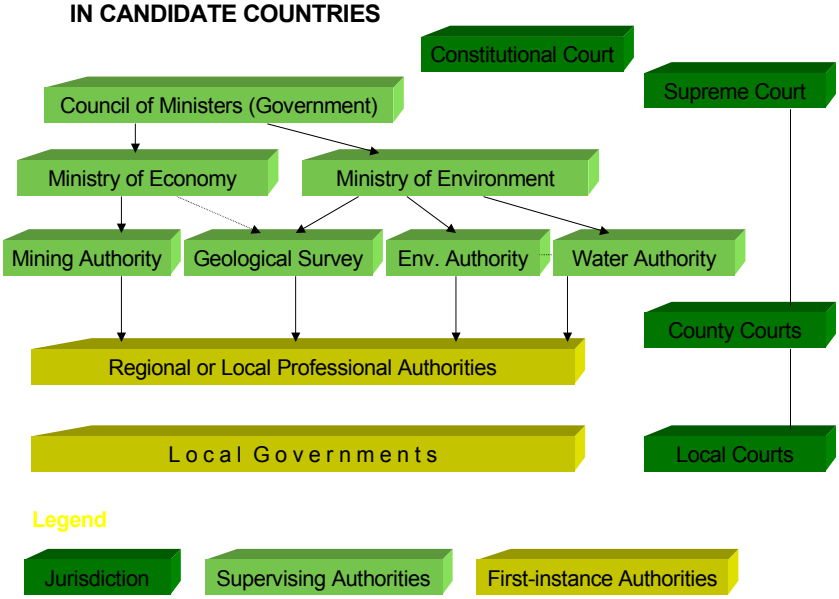
TYPICAL REGULATORY FRAMEWORK OF MINING IN CANDIDATE COUNTRIES



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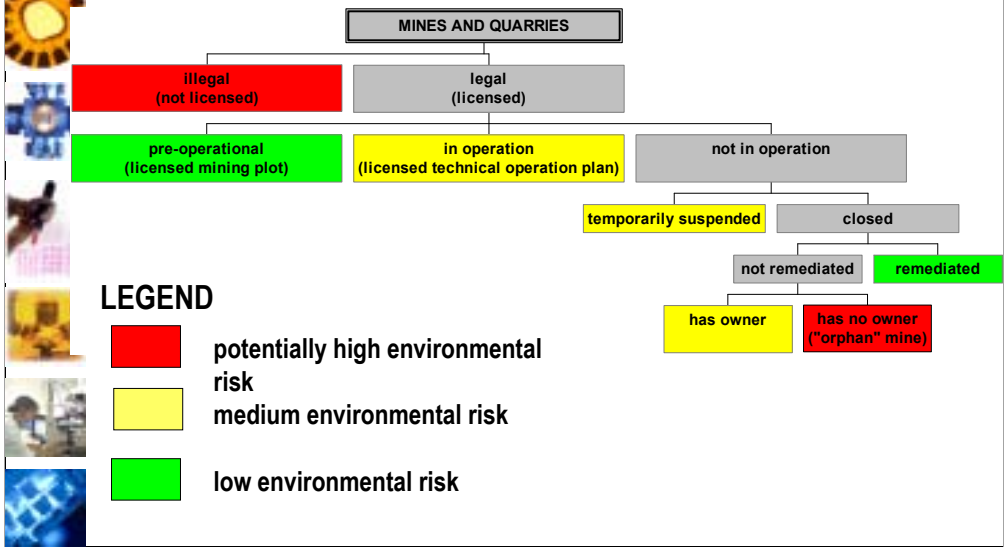
RESPONSE

regulations

LEGAL CLASSIFICATION OF MINES IN CANDIDATE COUNTRIES



LEGEND

- potentially high environmental risk
- medium environmental risk
- low environmental risk

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RESPONSE

regulations

Conclusions of the regulatory report







- Adoption of EU waste legislation is advanced.
- Mining legislation shows differences among Candidate Countries (e.g. ownership and scope).
- Opening and operation of mines are well regulated, closure and aftercare are less prescribed. Regulatory enforcement requires improvement.
- Geological data (including mineral resources) are well recorded, mining operation and waste data are less accurately managed.
- Mining regulations focus mainly on safety and not on environmental impacts.
- Limited use of royalty incomes for mitigating and remediating mining-related environmental impacts.

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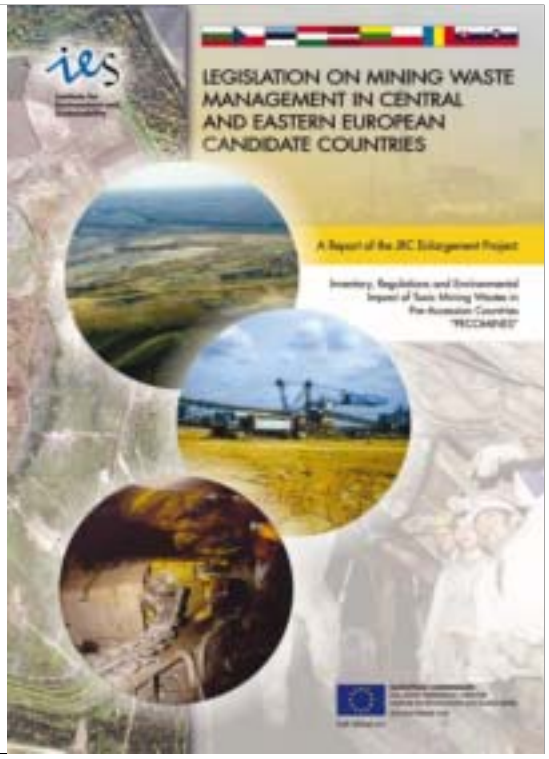
available on request

from

tamas.hamor@jrc.it



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pecomines: a pilot to support implementation

Directive of the European Parliament and of the Council on the management of waste from the extractive industries

Article 19 ... drawing-up inventories of closed waste facilities … identification ...and their classification according to the degree of their impact on human health and the environment

Article 20 Within three years… the Commission shall adopt ... definition of the criteria for the classification of waste facilities, … including threshold concentrations for hazardous waste and dangerous substances

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Contaminated Sites in Accession Countries

Community Actions on Soil

- Towards a Thematic Strategy on Soil Protection (COM(2002)179 final)
- Proposal for a Directive on Soil Monitoring (mid 2004)
- Proposal for a Commission Communication on contamination, erosion and organic matter content of soil and related research and legislative needs

Workshop in Budapest – end of October

- Develop and test a large-scale approach to the inventory and assessment of environmental impacts associated to contaminated sites
- Benchmarking historical heritage and national actions of 13 Accession and Candidate Countries
- Agree on methodologies and establish a platform for information exchange to collect, use and deliver back data