Feasibility and social acceptance of soil cleaning methods in developing economies

Example from the Republic of Poland

R. Kucharski, A. Sas-Nowosielska,
E. Malkowski, T. Lane

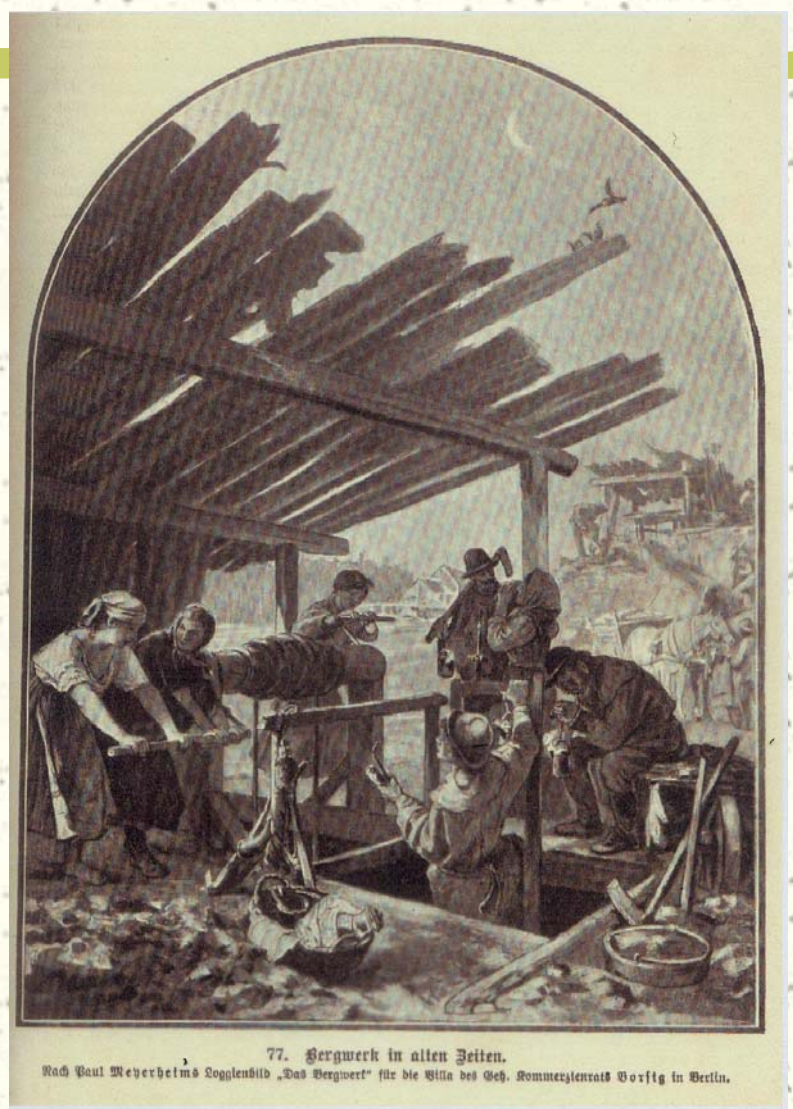
Institute for Ecology of Industrial Areas
Katowice, Poland

POLAND, USIR and the neighbours

- 2.1% of area of country
- 11% of inhabitants of country
- 17% of industrial production of country
- 20% of dust emission of country
- 30% of SO_2 emision of country

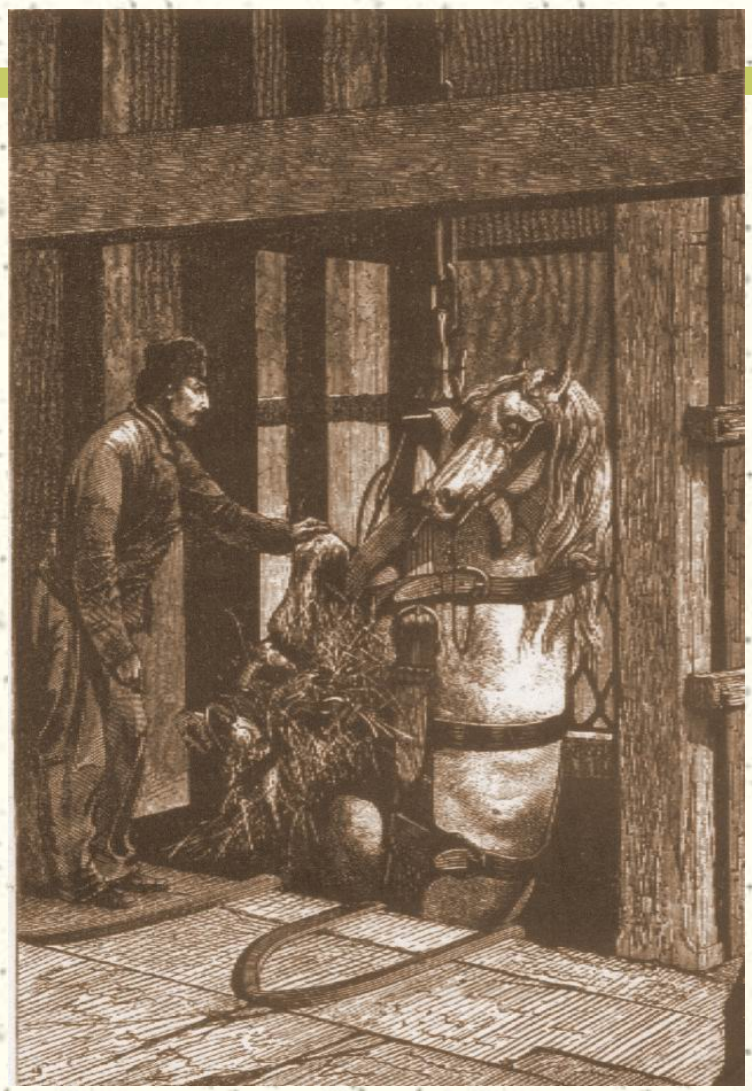
The Ancestors

(XIVth Century)



77. Bergwerk in alten Zeiten.
Nach Paul Meyerheims Logglenbild „Das Bergwerk" für die Villa des Geh. Kommerzienrats Borsig in Berlin.

Animals and people at work



The First Owners
(first decade of XXth Century)

Zinc Foundry
(1930)

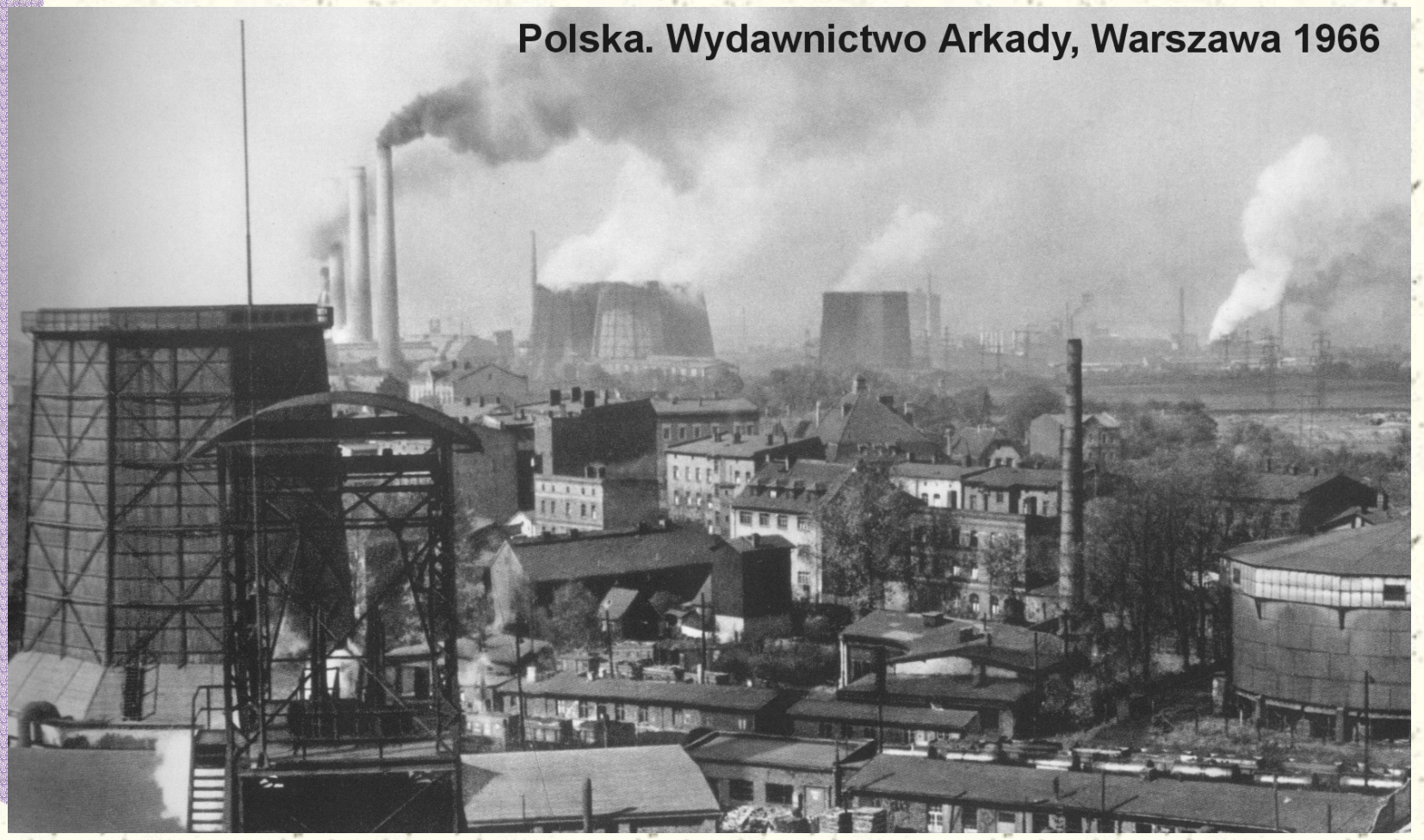
Unwanted co-existance

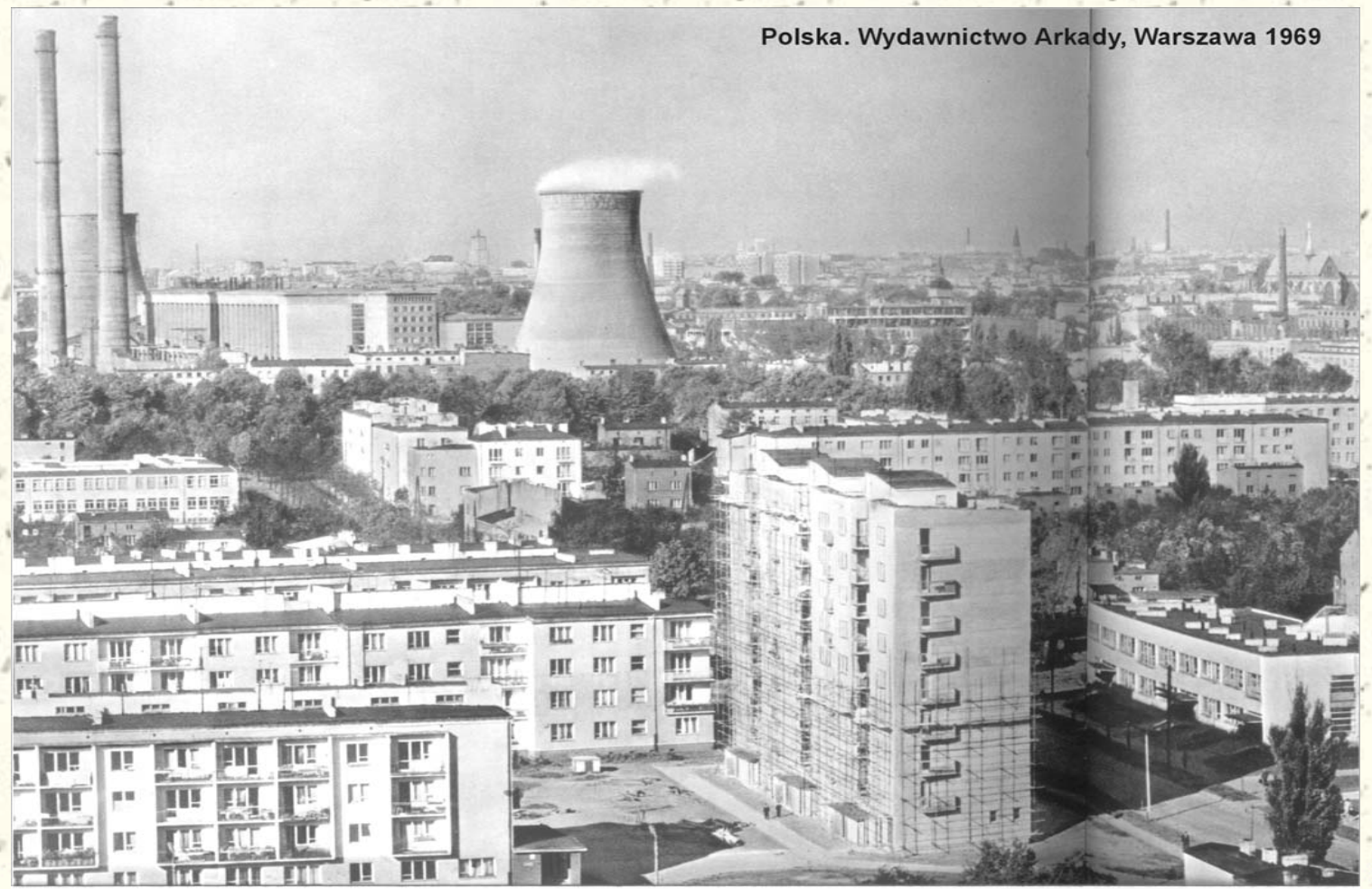
Late fifties of XXth Century

Polska 1944-1965. Spółdzielnia Wydawnicza Książka I Wiedza, Warszawa 1966


Województwo katowickie w Polsce Ludowej.
Śląski Instytut Naukowy "Śląsk", 1967

Dwelling and working together


Polska. Wydawnictwo Arkady, Warszawa 1966

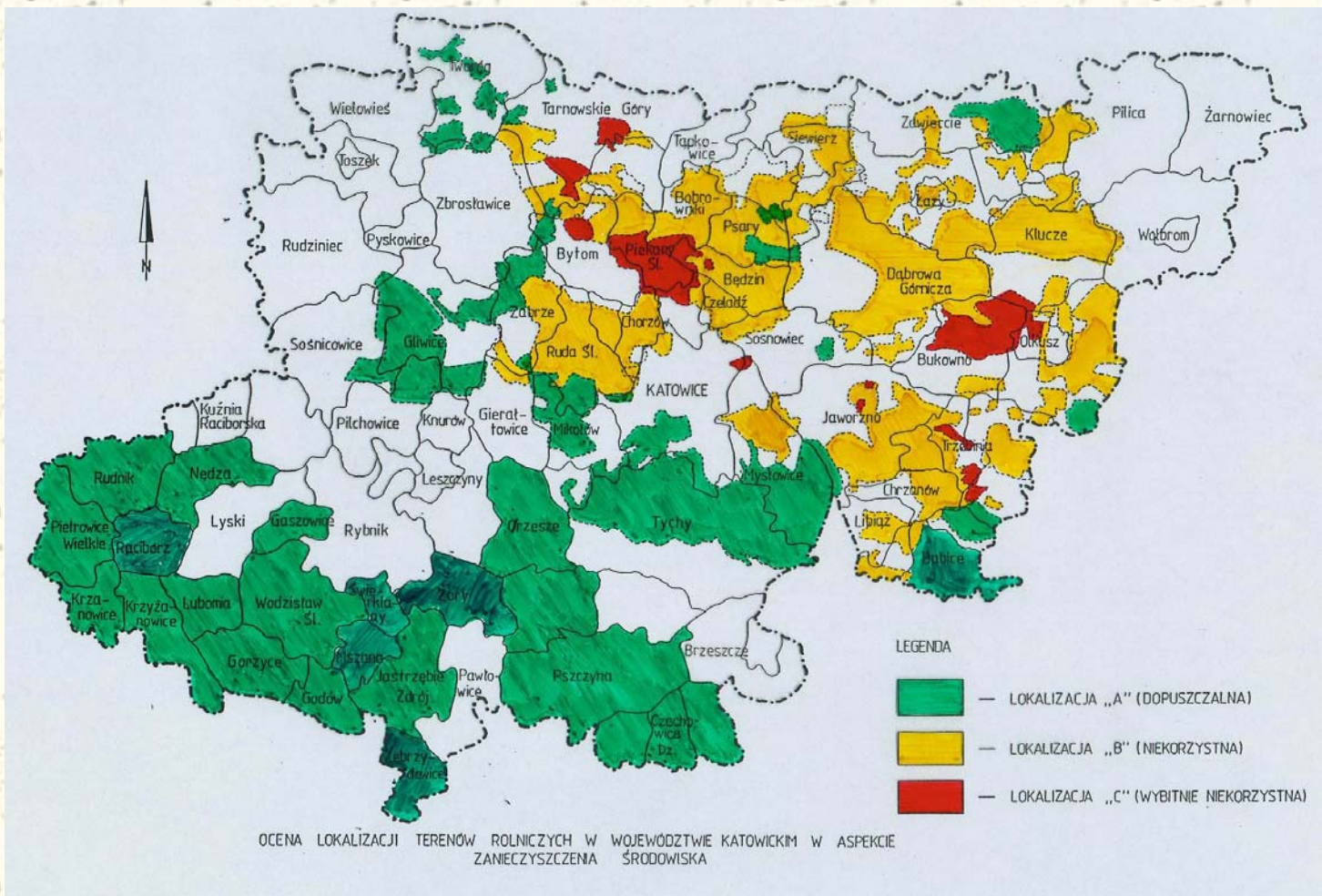

Polska. Wydawnictwo Arkady, Warszawa 1969


Polska 1956-1965, Spółdzielnia Wydawnicza Książka i Wiedza
Warszawa, 1966

Basic source of energy

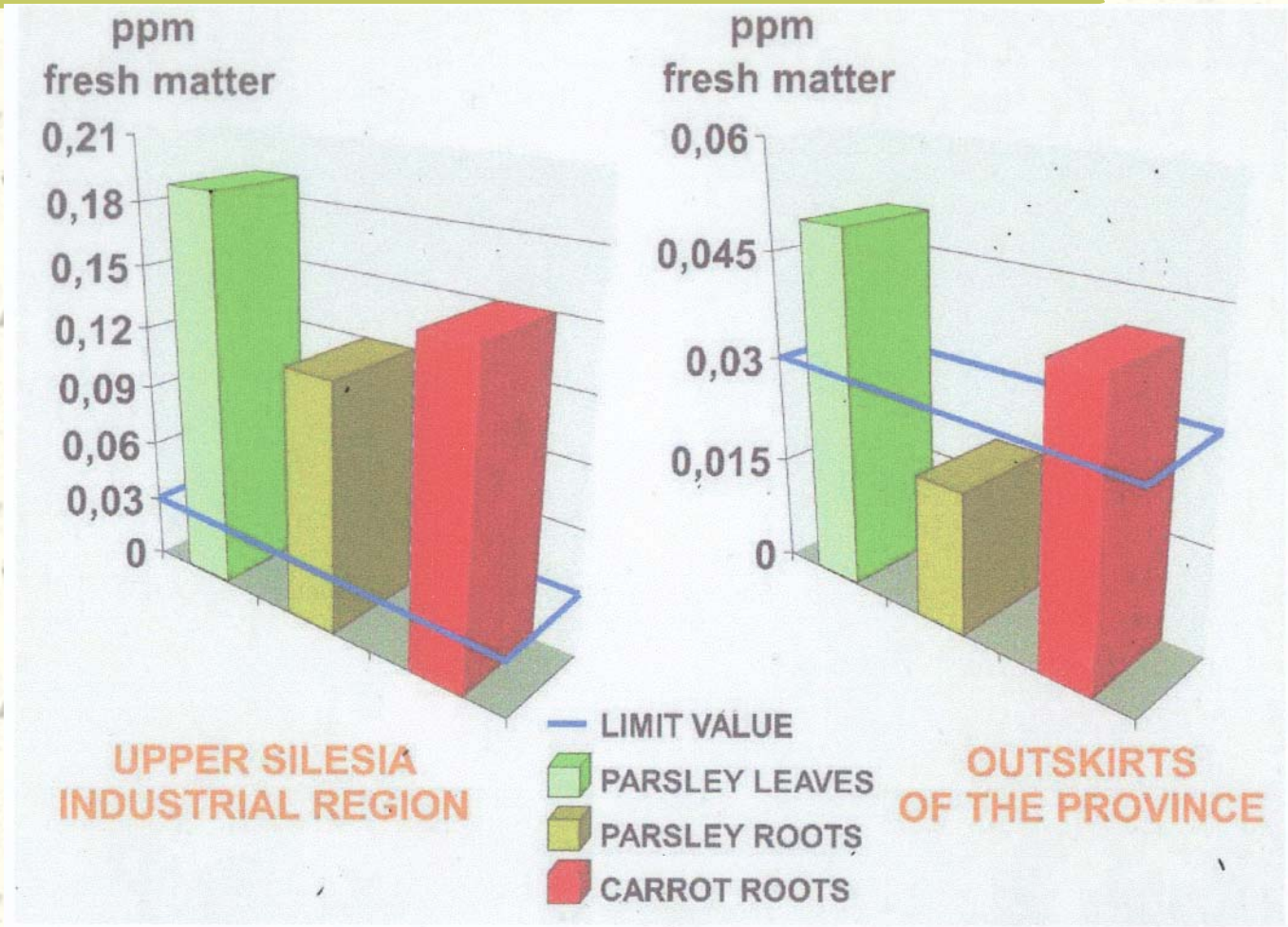
Location of former Red Army Bases in Poland

Soil pollution at USIR, Poland



OCENA LOKALIZACJI TERENÓW ROLNICZYCH W WOJEWÓDZTWIE KATOWICKIM W ASPEKCIE ZANIECZYSZCZENIA ŚRODOWISKA

Contamination of Vegetables with Cadmium in the Katowice Province



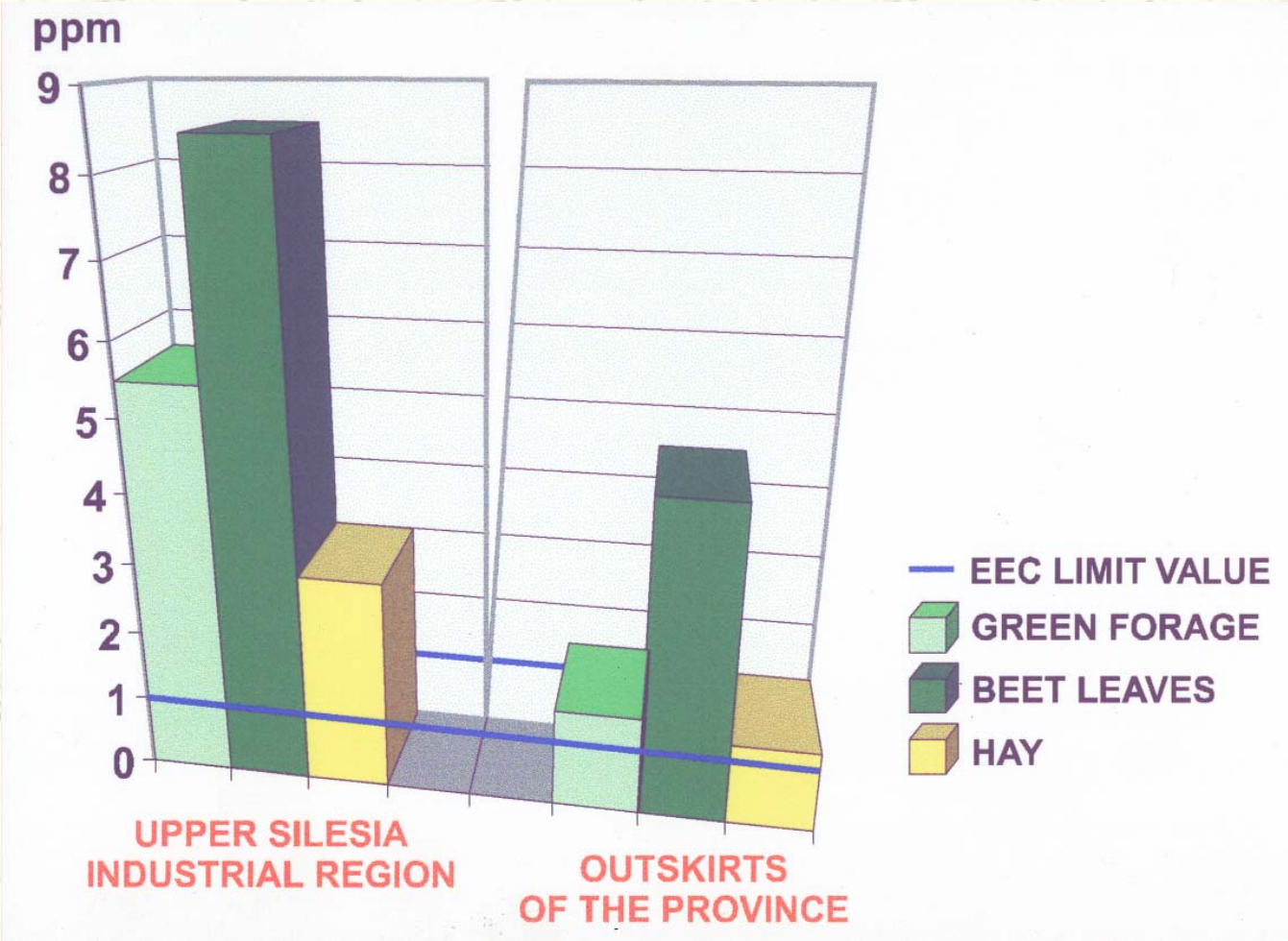
Effects of washing on metal concentrations of some species of vegetables

Vegetable		Concentration (μg/g)	
		Pb	Cd
Parsley leaves	Washed	7.5	0.74
	Unwashed	9.2	0.78
Celery leaves	Washed	4.6	0.84
	Unwashed	6.0	0.85
Lettuce	Washed	1.7	0.36
	Unwashed	2.3	0.41

Effects of peeling on metal concentrations of some species of vegetables

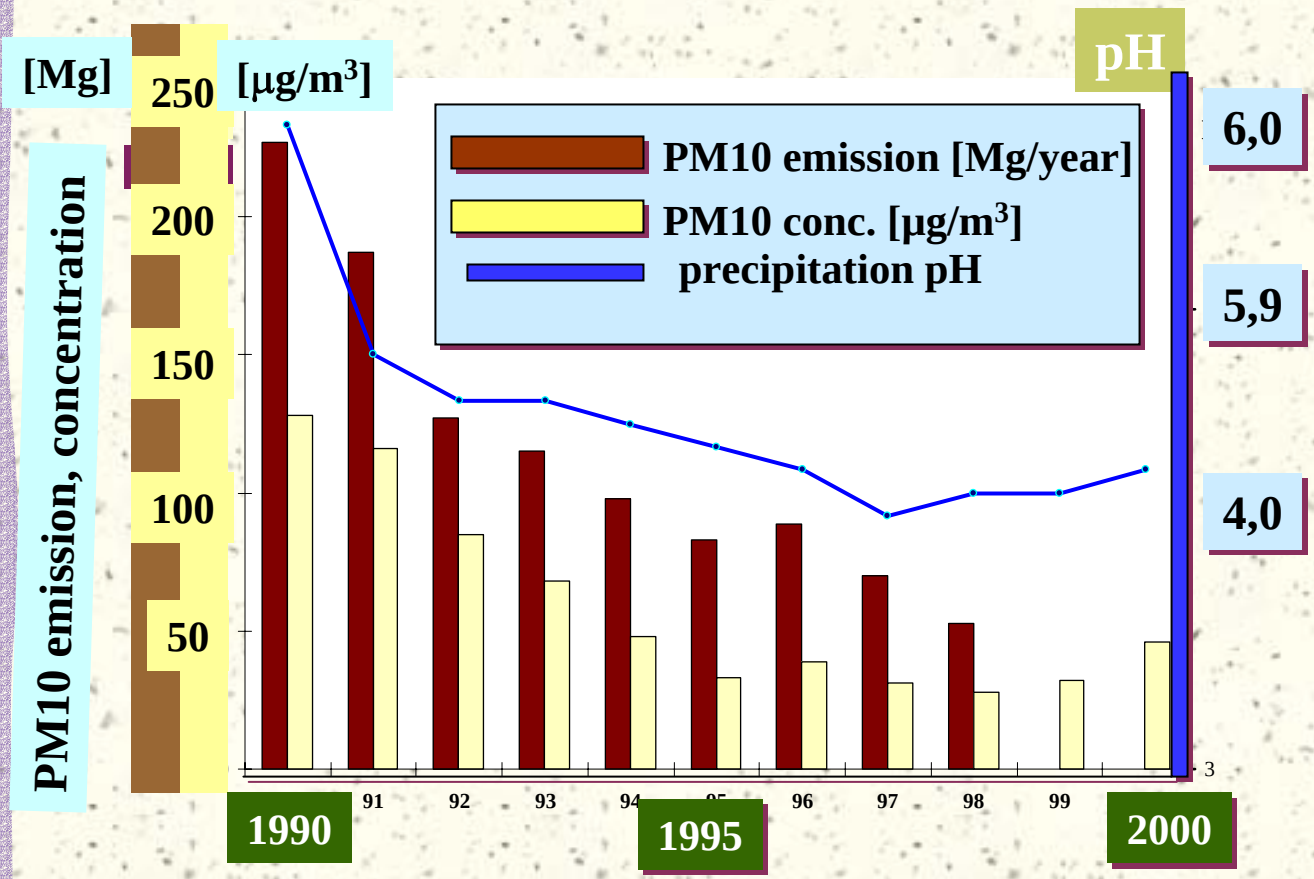
Vegetable		Concentration (μg/g)	
		Pb	Cd
Parsley root	Unpeeled	6.3	1.10
	Peeled	4.7	0.91
Carrot root	Unpeeled	8.0	1.00
	Peeled	6.2	0.69
Beet root	Unpeeled	7.2	0.82
	Peeled	6.2	0.63

Contamination of pasture plants with cadmium in the Katowice Province

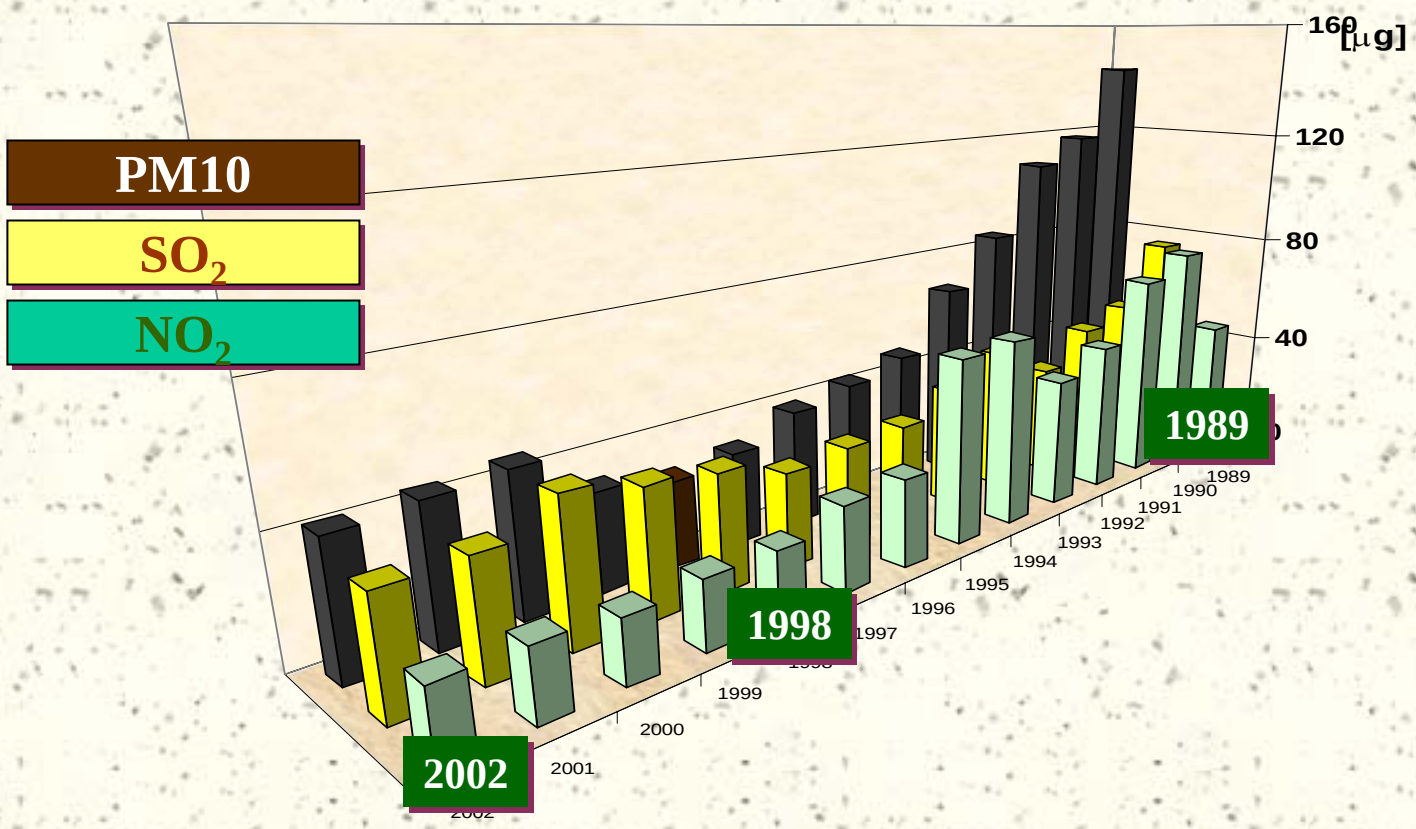


Excess of Zn in soil

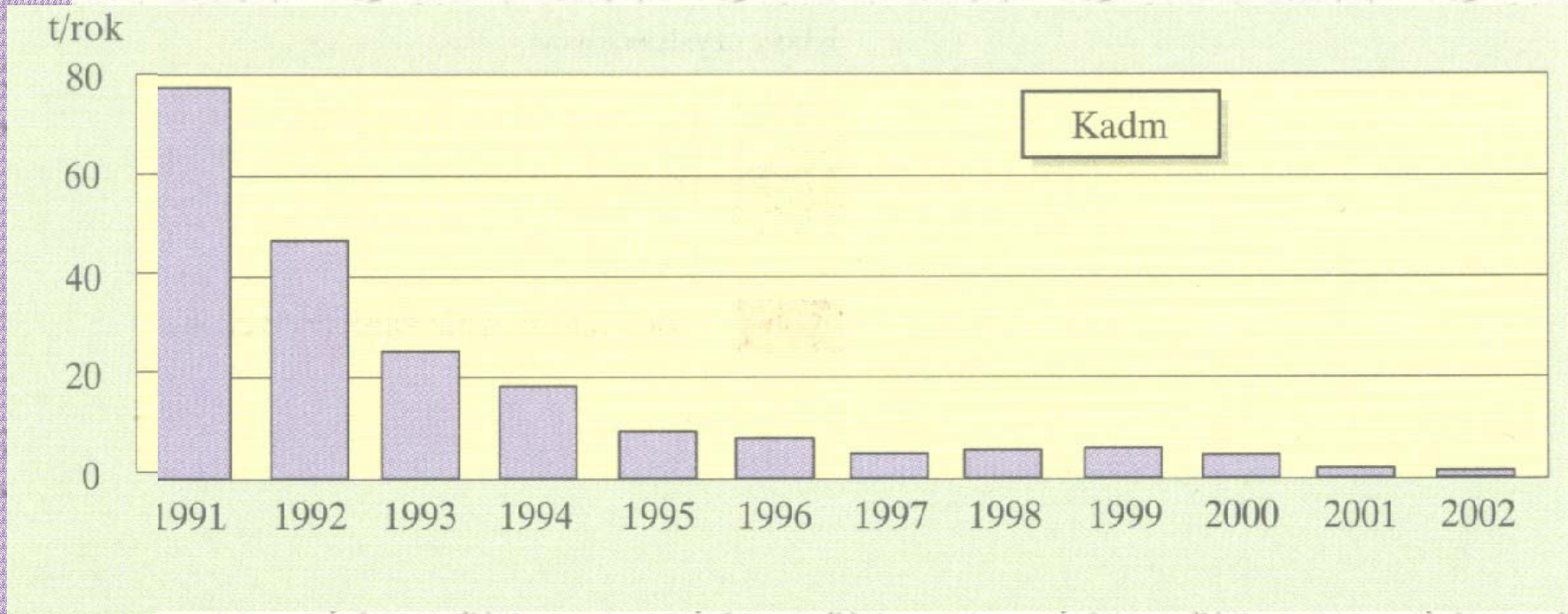
Atmospheric precipitation acidity changes versus PM10 emission and concentration



Changes of PM10, SO_2 and NO_2 Concentrations in Years 1989 - 2002



Cadmium discharge to Baltic Sea 1991-2002



Zinc smelter
Tailing decomissioning

A common relationship

Remediation technology costs

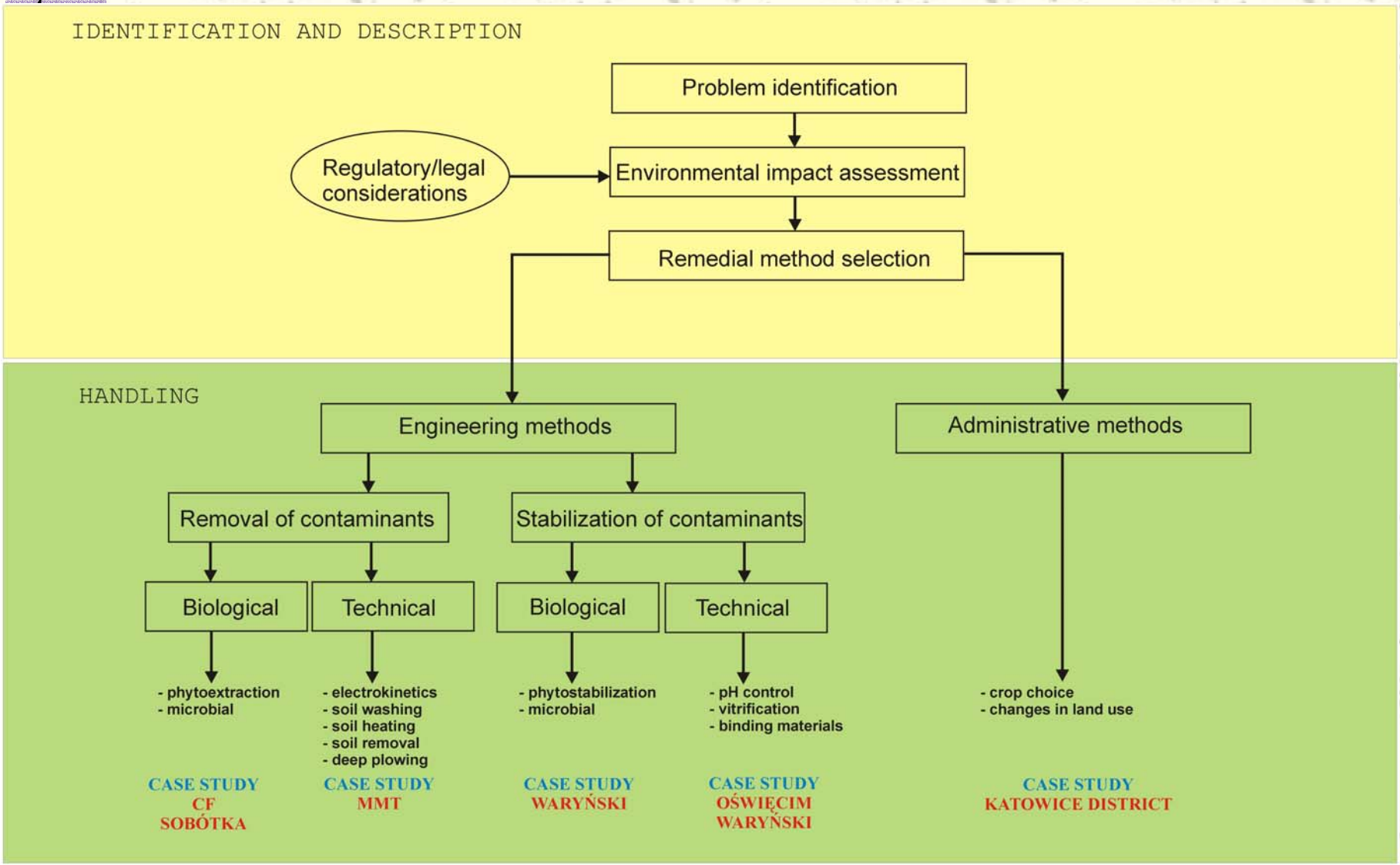
TECHNOLOGY	Costs ($/t)
PHYTOREMEDIATION	25-100
SOIL WASHING	50-150
ACID LEACHING	150-400
STABILIZATION *IN SITU*	111-205
VITRIFICATION *IN SITU*	300-500
THERMAL DESORPTION	150-500
ELECTROKINETICS	50-300
LANDFILLING	100-500

(Source: Amaethon Ltd., 2004)

Land categories

- **Very sensitive**
  - allotments
  - farming areas
  - single house with garden
  - playgrounds
  - kindergartens
- **Sensitive**
  - houses
  - resthomes
- **Less sensitive**
  - offices
  - shops
  - industrial grounds
- **Slightly sensitive**
  - parking lots
  - roads

Contaminated land management

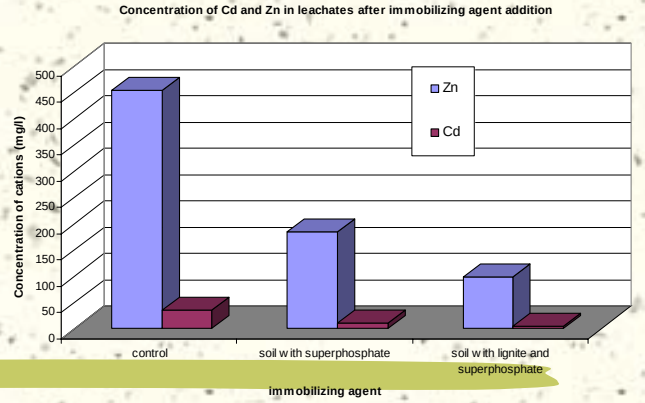


Phytoremediation – laboratory trials

Phytoextraction

Phytostabilization

Conclusions



- The most suitable for revegetation purpose are local, spontaneously growing species, often considered as the weeds, whose growth is assisted with fertilizers

- Phytostabilization can be cosidered a feasible method of land management, even in case of very heavily polluted soils, providing that an appropriate care of plant growth conditions is taken of,