

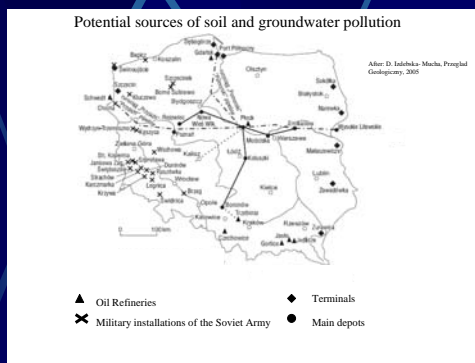
Use of Monitored Natural Attenuation Concepts at Contaminated Sites in Poland

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Contaminated land in Poland – 2004 yr

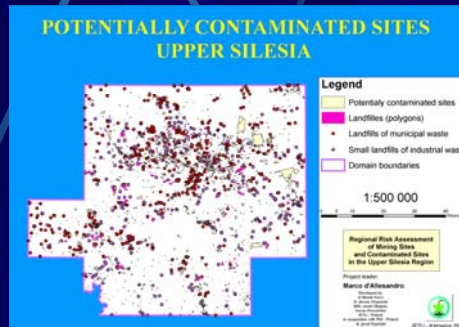
- 675.5 km² – degraded land in Poland, requiring remediation
- 23.4 km² – remediated area

(Ochrona Środowiska - GUS, 2005)



Land contamination

- PECOMINES project Upper Silesia case study
- 6 thousand potentially contaminated sites identified in Upper Silesia



Natural Attenuation basic rules

- There should be no risk for humans or the environment involved
- There is a proof that degradation of the contamination takes place in the environment
- The contamination plume should be decreasing (downward trend is observed)

Factors of MNA application in Poland

- Polish legislation
- Administration practices
- Available technical solutions
- Monitoring systems and site characterisation practices
- Scientific and practitioners potential

Soil regulations – AEPA, 2001

- Act on Environmental Protection Law (AEPA), 27 April 2001- the main Polish legal regulation referring to contaminated land:
 - Any holder of land on which soil contamination or damage of natural land's lay-out exist, is liable for its reclamation
 - Soil remediation means bringing soil back to conditions which meet soil quality standards (Article 103)

Soil regulations - OSQS, 2002

- Ordinance of the Ministry of Environment on Soil Quality Standards (OSQS) issued on 9 September 2002, pursuant to Article 105 of AEPA
 - assessment of contaminated sites was designed as three-phase process but in fact this process is not described in the regulation
 - land is regarded as contaminated when concentration of at least one substance exceeds the soil quality standards
 - soil quality standards established for three categories of land
 - SQS can be defined as "cut off values"
 - corrective actions are needed wherever values are exceeded
 - if soil quality standards are exceeded as a result of naturally occurring substances, it is considered that standards are not exceeded

OSQS, 2002 Land categories

Group A

- a) land located in areas under protection pursuant to the Water Act 2001
- b) land located in areas under protection pursuant to the nature protection laws; unless the contamination constitutes a threat to human health or to the environment, no special action is required - such land will however also fall under Group B or C and will be subject to the provisions thereof

Group B

agricultural land except land under water in ponds and ditches, forest land and tree-covered or shrub-covered, wasteland, and developed and urbanised land except industrial land, mining land and land used for transportation

Group C

industrial, mining and transportation land

Groundwater regulations

- Act on Water Law (WA), 18 July 2001
- Ordinance of the Ministry of Environment including limit values for groundwater quality indicators in groundwater classes (OGQS) issued on 11 February 2004, pursuant to WA (2001)
- Limit values established for water used for drinking purposes (sanitary requirements)

New groundwater regulations

- a draft of a new Ordinance of the Ministry of Environment including a new limit values for groundwater quality indicators prepared for consultation
- the new Ordinance is adjusted to the requirements of Framework Groundwater Directive (FGD 2000) and the proposal of a Groundwater Daughter Directive (GDD 2003)

Administrative procedures

- Technical guidelines for groundwater monitoring and site characterisation
- Technical Guidance on Delimitation of Areas Where Soil Quality Standards Are Exceeded, IEP 2004
 - to facilitate making decision on scope, frequency and costs of investigations
 - includes recommendations on soil sampling strategy and analytical methods
 - its status is not obligatory but only recommended
- Case by case approach prevails, Actions are undertaken under various regulations including waste management issues

Monitoring and site characterisation

- National, regional and site groundwater monitoring schemes
- Soil monitoring and periodic surveys, general, agricultural land and site specific surveys
- The existing monitoring schemes do not support the MNA approach
- Lack of extensive data enabling comprehensive and reliable site characterisation, assesment and remediation planning
- Lack of contaminated site characterisation protocols and schemes including setting of clean-up goals

Technologies

- Prevailing pump and treat, dig and dump technologies
- Time issue is important especially in investment driven remediation
- Biotechnologies ex situ on site and off site
- In situ biotechnologies, air sparging used in some cases
- Limited use of site characterisation techniques and modeling

MNA application potential sites

- Contaminated industrial sites
- Sites with extensive groundwater contamination (mineral oil, petrol)
- Old industrial landfills
- Complex groundwater contamination
 - hydrogeological system complexity
 - limited knowledge of contaminated source

MNA potential cases

Site category	Risk for humans or the environment	Process of contaminant degradation	Plume characteristics
Contaminated industrial sites	✓	✓	
Sites with extensive groundwater contamination	✓	✓	✓
Old industrial landfills		✓	
Complex groundwater contamination sites	✓	✓	✓

Contaminated industrial sites

- Industrial sites in which the remediation – source removal was performed
- Sites contaminated with organic pollution (hydrocarbons, chlororganics, tars, BTEX, chloroorganics)
- Residual contamination exists
- Processes of continuous attenuation can be involved

Czechowice Dziedzice

- Czechowice - Dziedzice petroleum plant
- Ground and groundwater contamination with acidic tar
- Contaminated source - acid tar heaps were already removed
- Question of residual pollution still exists
- Risks for inhabitants living nearby were identified
- IETU performed testing of biopile and bioremediation techniques on this site



Groundwater contamination

- Point sources with groundwater plume developed:
 - military sites with extensive groundwater contamination (diesel fuels, petroleum)
 - railway sites fuel deposits – around 40 potential sites: Węgliniec railway site
 - Industrial sites – leaks from installations (hydrocarbons)

Węgliniec site

- Fuel deposit (diesel) for the railway
- Around 80% off the hydrocarbons removed in a remediation action already undertaken
- The LNAPL (free phase still exists)
- The plume is developed in sand and gravel Quaternary layer



Old Industrial landfills

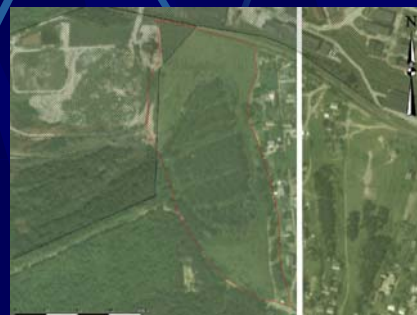
- Industrial landfills closed in previous technical/legal regimes
- Many industrial landfills fits into this category
- The question is how those sites should be managed
- Risk assessment issue
- Possibility of use of the landfill sites for redevelopment

Jaworzno

- Jaworzno site (close to Katowice) where a variety of organic substances were deposited by chemical industry, including hydrochlorocarbons, pesticides, cyanides
- The landfills are closed according to the previous technical requirements
- Groundwater contamination detected – Quaternary with cyanides (suspected current landfilling operations)
- Capping is the basic option for site remediation – already planned

Jaworzno

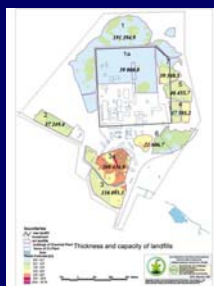
- 4 landfills A, B, K and central hazardous waste landfills
- Landfill K is the most contaminated
- Area: 5,6392 ha
- DDT/DDE/DDD, Dieldrin, endrin, a-HCH, b-HCH, g-HCH, cyjanki



Complex groundwater contamination

- Groundwater contamination found in a complex hydrogeological situation (e.g. carstic system)
- Difficulties in source removal encountered – migration of the contaminants into the hydrogeological system
- Source cannot be identified

Chemical Plant – main pollution source



• $1.5 \times 10^6 \text{ m}^3$ ($2.7 \times 10^6 \text{ Mg}$) waste materials deposited on uncontrolled dumps (26 ha) – total area 34 ha

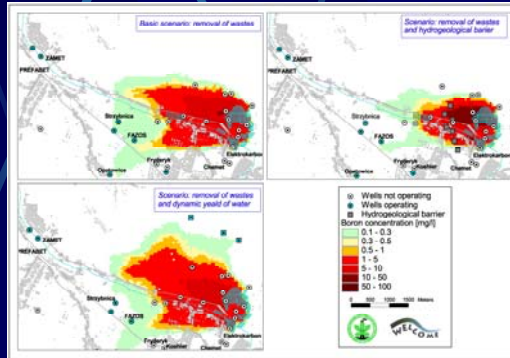
• The annual leachate load from landfills:

- B – 6.63 Mg
- Ba – 80.4 Mg
- Sr – 5.8 Mg
- Zn – 1.4 Mg
- SO₄ – 274.5 Mg

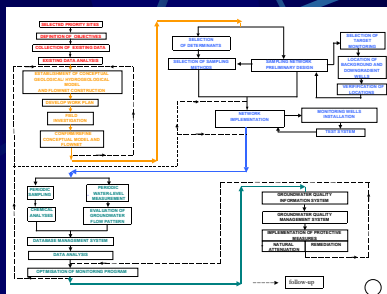


Contaminated groundwater

- Source (wastes) partially removed – between 1995 - 2008
- Remaining essential groundwater contamination – Triassic and Quaternary
- Inorganics (boron as the main pollutant in groundwater system)
- Various plume development scenarios researched (WELCOME project)
- monitoring system oriented on controlling the substances behaviour in the system is the basic management option

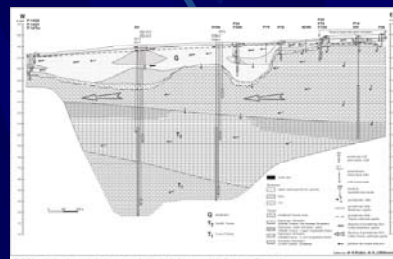


Monitoring Program



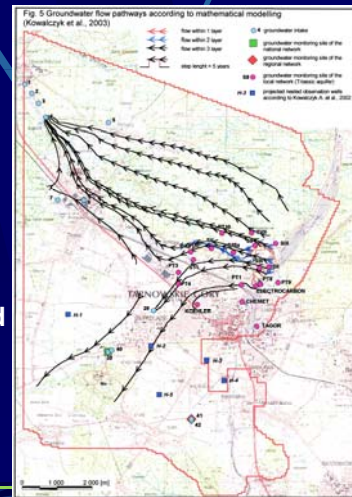
- A new organization of a monitoring system for the site, is proposed

- Verified sampling protocol, i.e. sampling technique, frequency and parameters to be measured (number and range)



Groundwater contamination - trichlorethene

- Contamination detected in 2000 - 2003
- Around 30 groundwater wells closed because of TRI contamination
- Substance occurs in the water supply system (dissolution is required)
- In 2008 there is observed gradual drop in the concentrations
- Sources not confirmed, only suspected
- No action, except for monitoring, undertaken



Polish - German cooperation

- Proposed cases can be analysed according to the German legal requirements and practices including MNA approach and
- It can be demonstrated whether MNA is an option from environmental, legal, technical, social or economical point of view
- Possibilities of implementing the MNA approach in Poland can be appropriately evaluated with defining the eventual German assistance
- The cases can be discussed during a workshop with the participation of national and regional administration, scientists and practitioners
- Sites can be selected and proposals prepared to establish reference sites and model approaches developed

