NATO SPS Study "Prevention and Remediation Issues in Selected Industrial Sectors "
Ljubljana, 17 – 22 July 2007

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Remediation of Cretaceous Sediments affected by uranium in-situ leaching (ISL) in the Czech Republic

MINISTRY OF ENVIRONMENT, CZECH REPUBLIC
Prague 2007

NATO SPS Study "Prevention and Remediation Issues in Selected Industrial Sectors "
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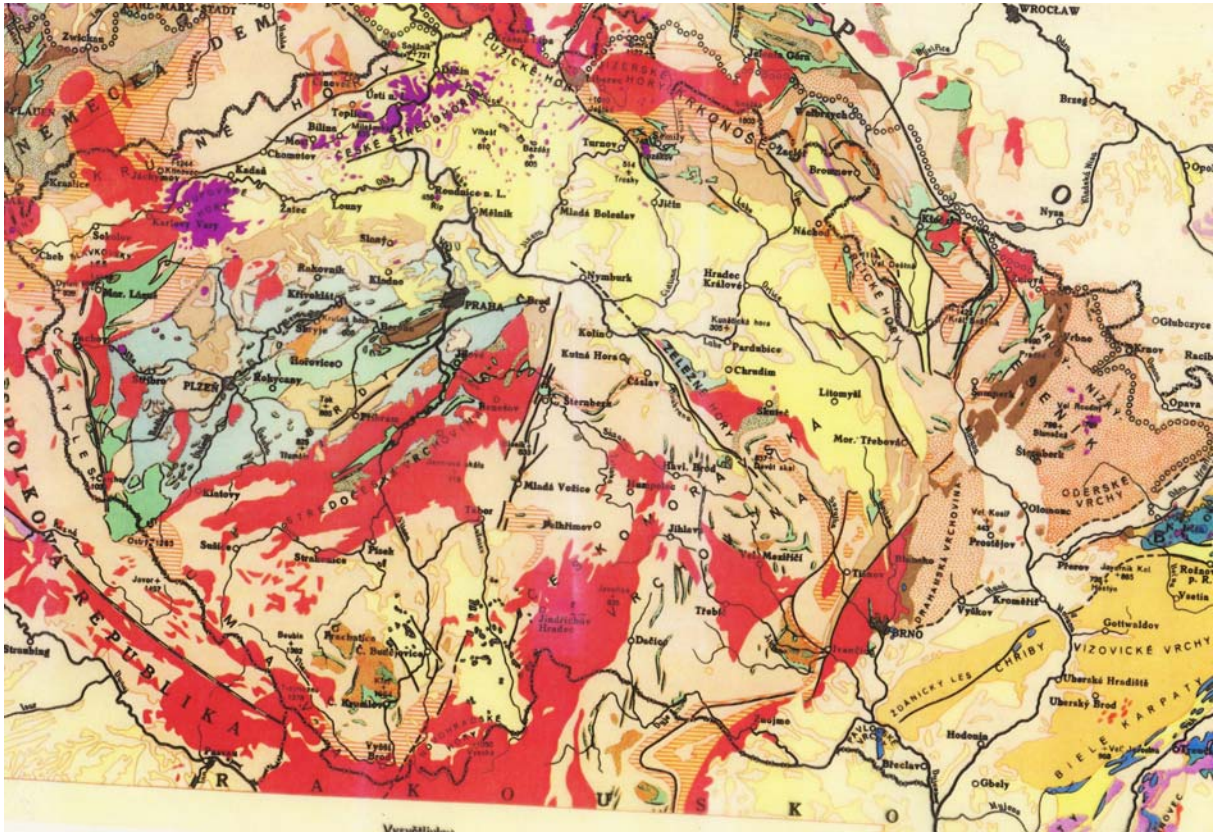

Geological map of the Czech Republic **Scale 1 : 1 000 000**

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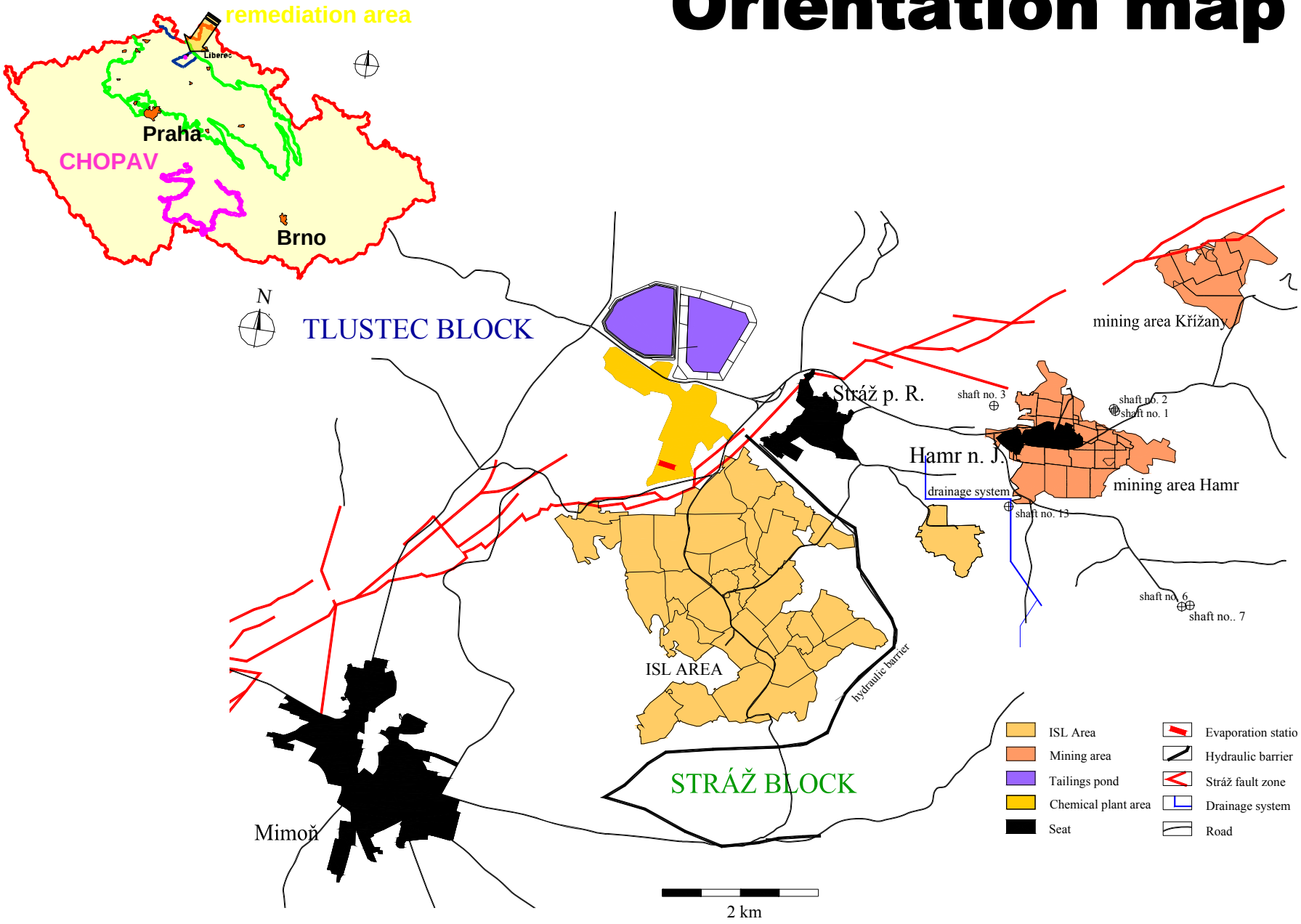
Orientation map



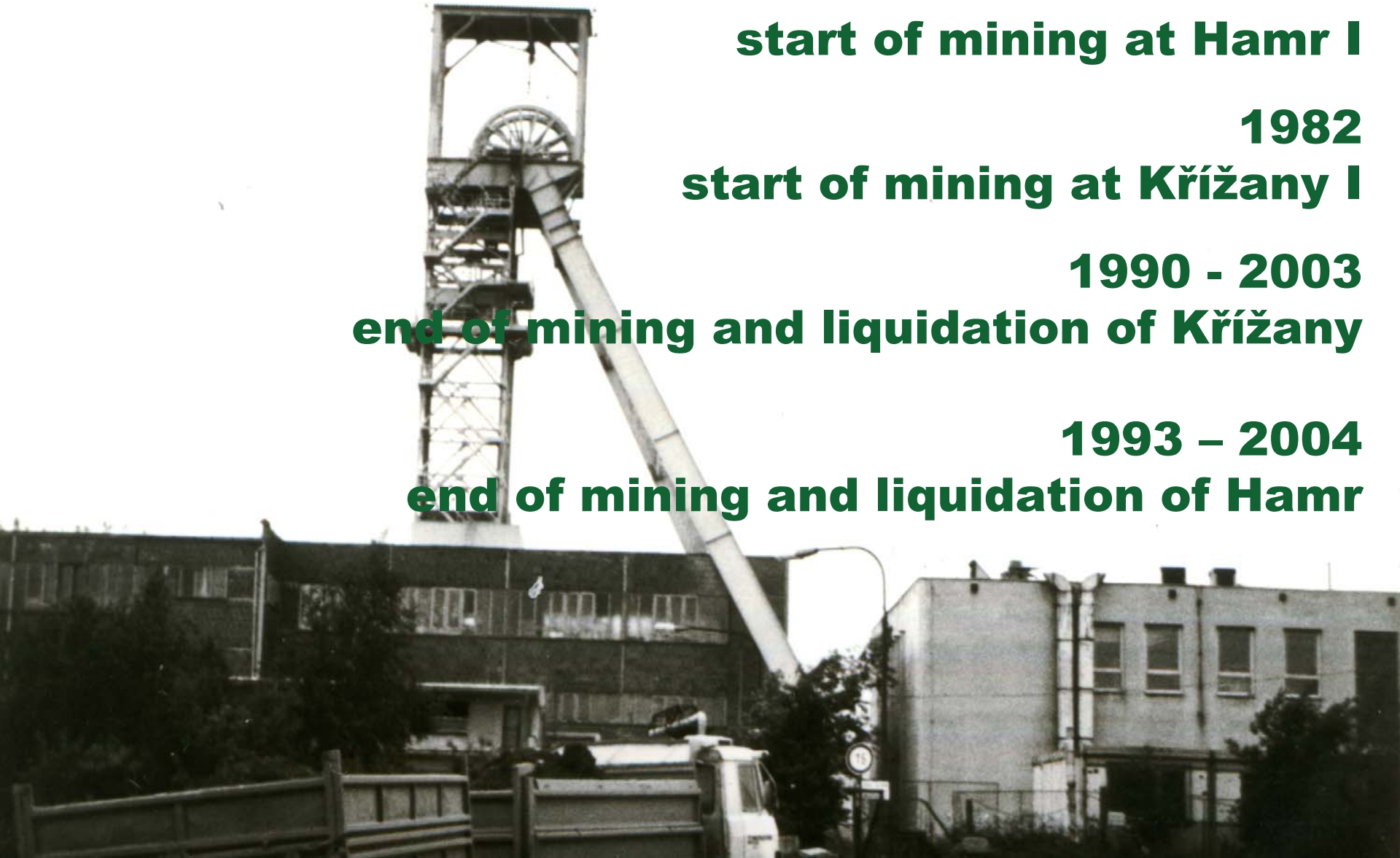
History of deep mining

1978
start of mining at Hamr I

1982
start of mining at Křížany I

1990 - 2003
end of mining and liquidation of Křížany

1993 – 2004
end of mining and liquidation of Hamr

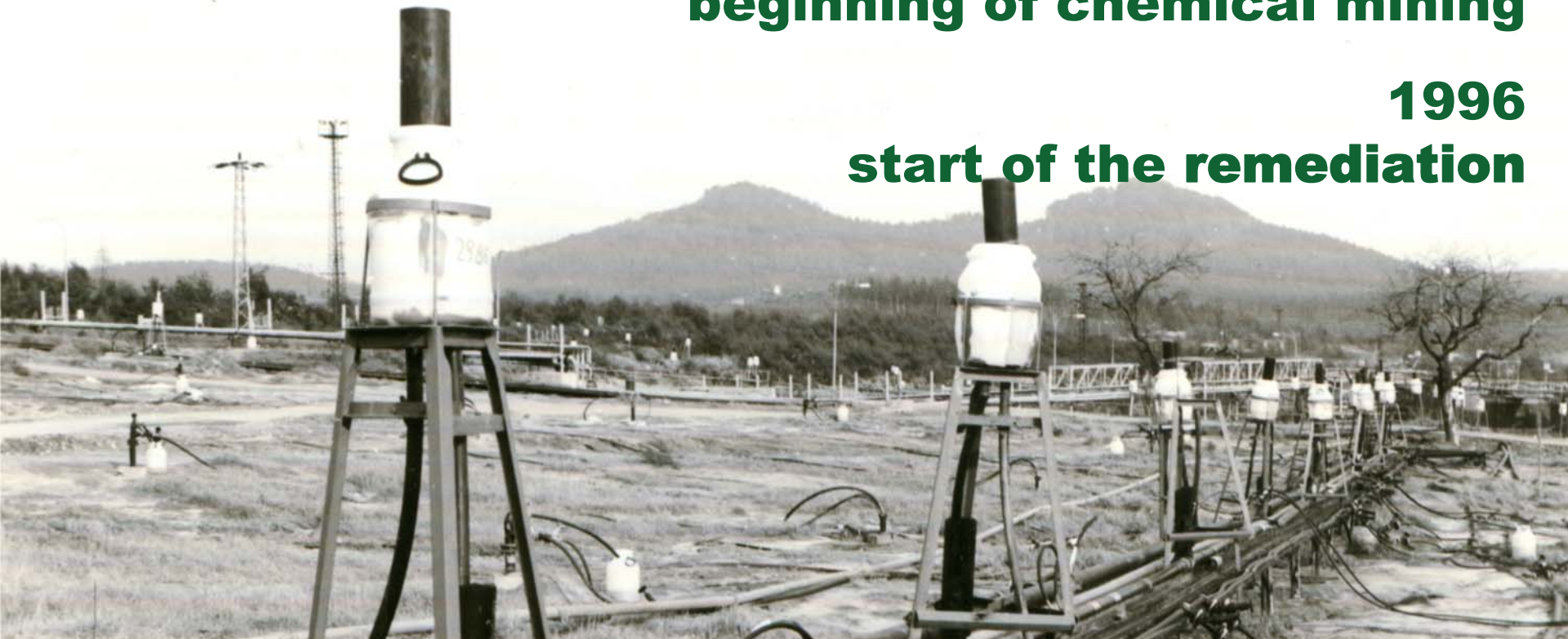


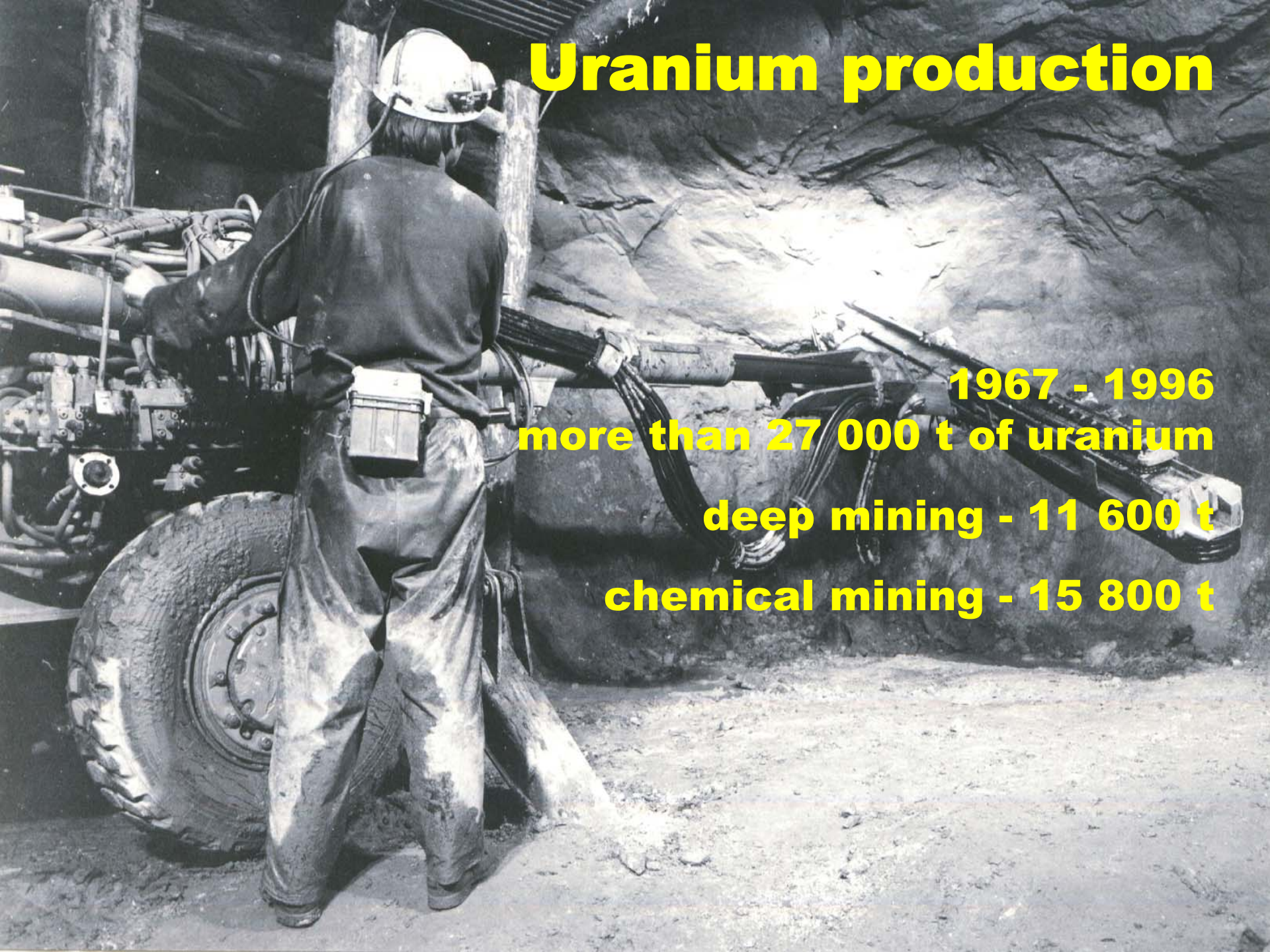
History of chemical mining

1966 - 1967
1st leaching experiments

1974
beginning of chemical mining

1996
start of the remediation





Uranium production

1967 - 1996

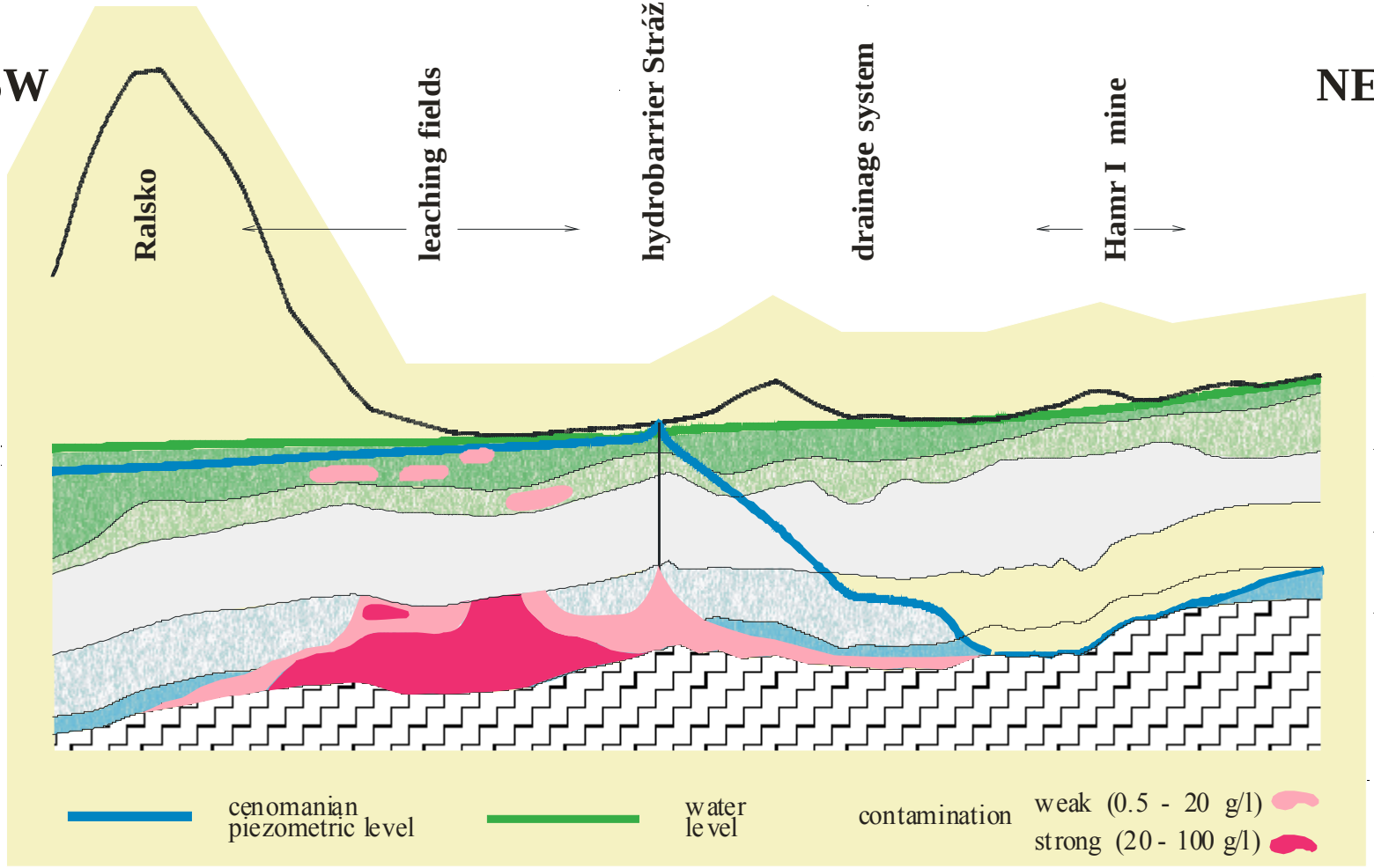
more than 27 000 t of uranium

deep mining - 11 600 t

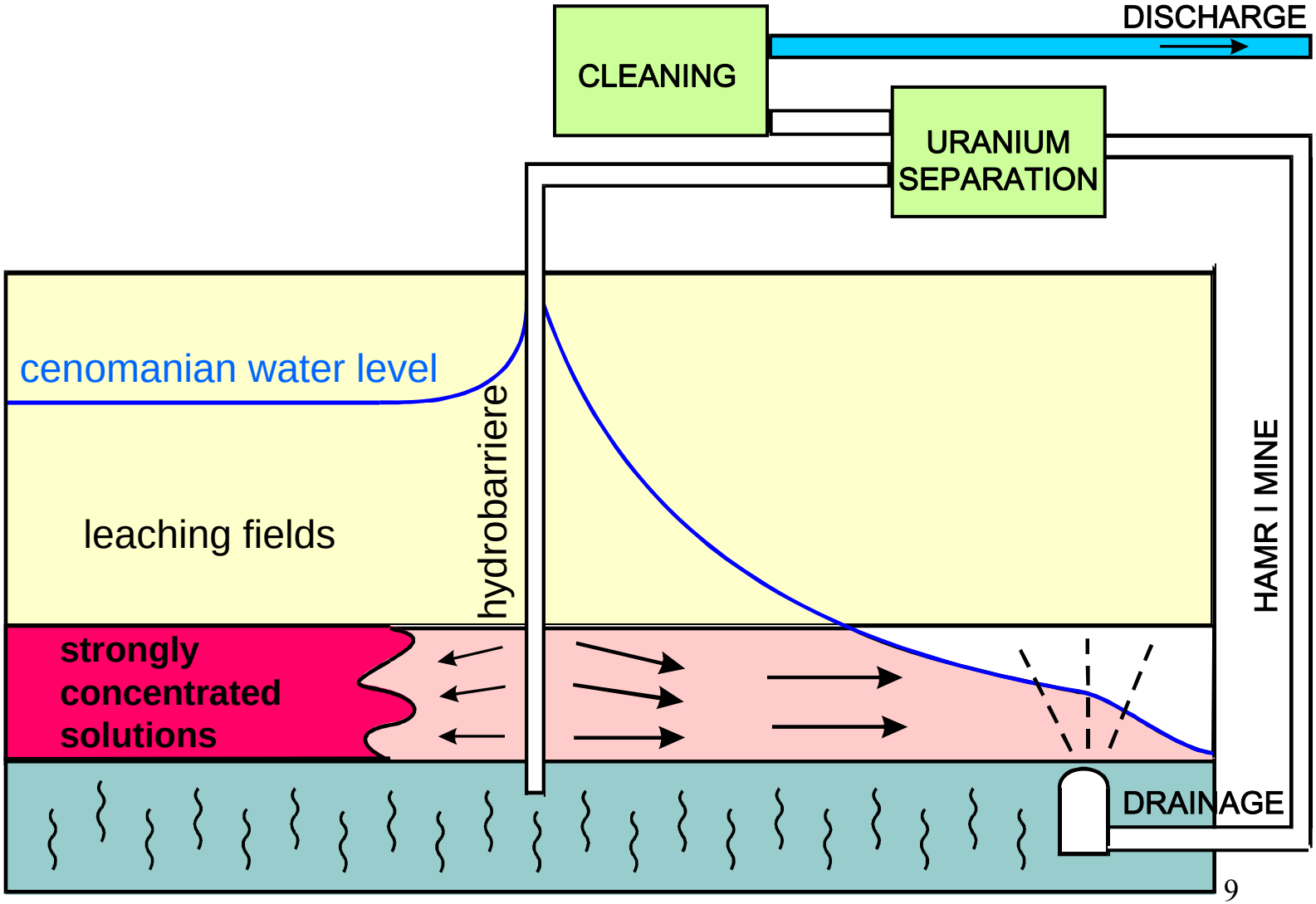
chemical mining - 15 800 t

Stráž - chemical treatment plant and tailings ponds

Schematic cross-section of the area

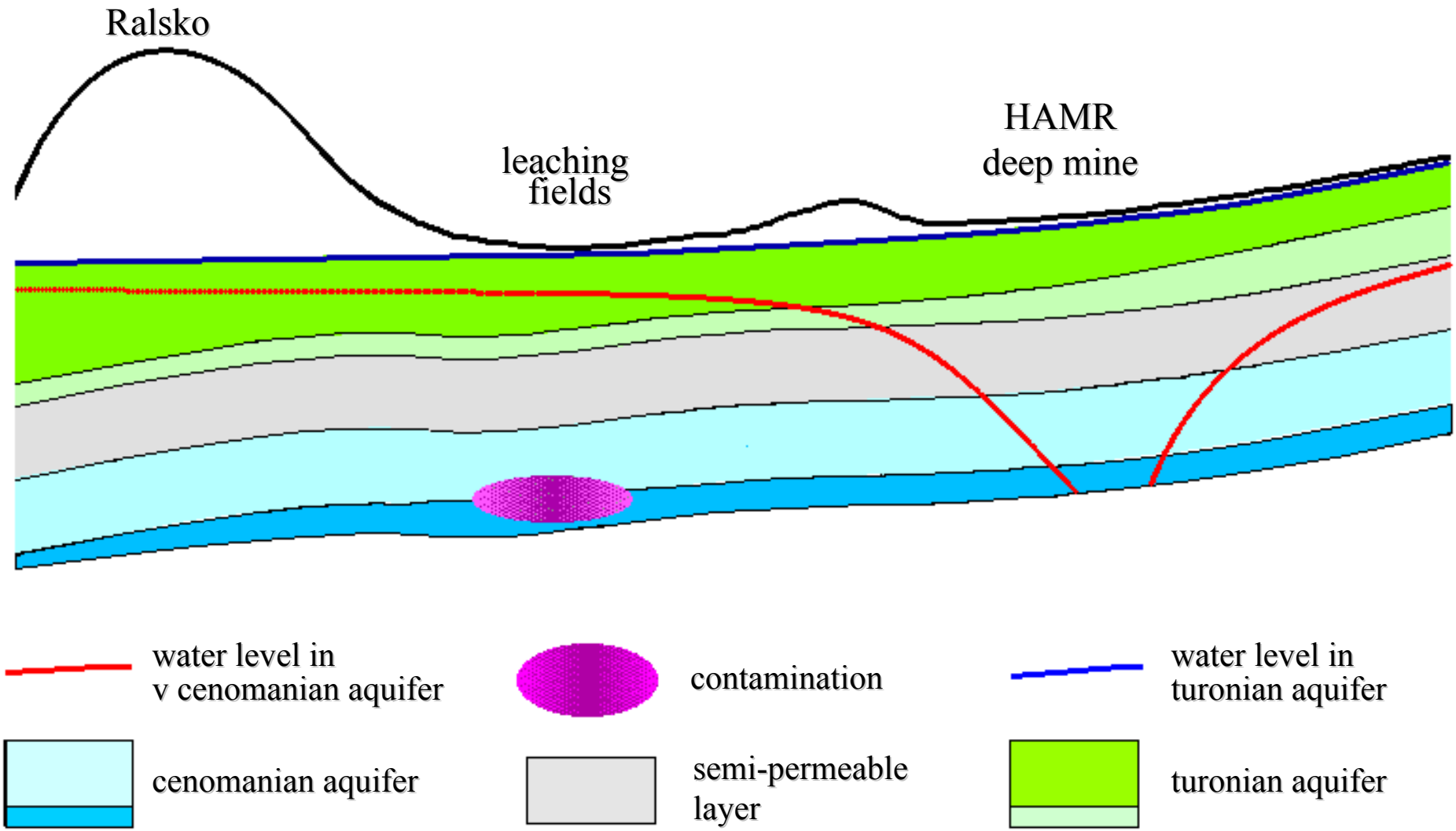


Principle of hydrobarriere



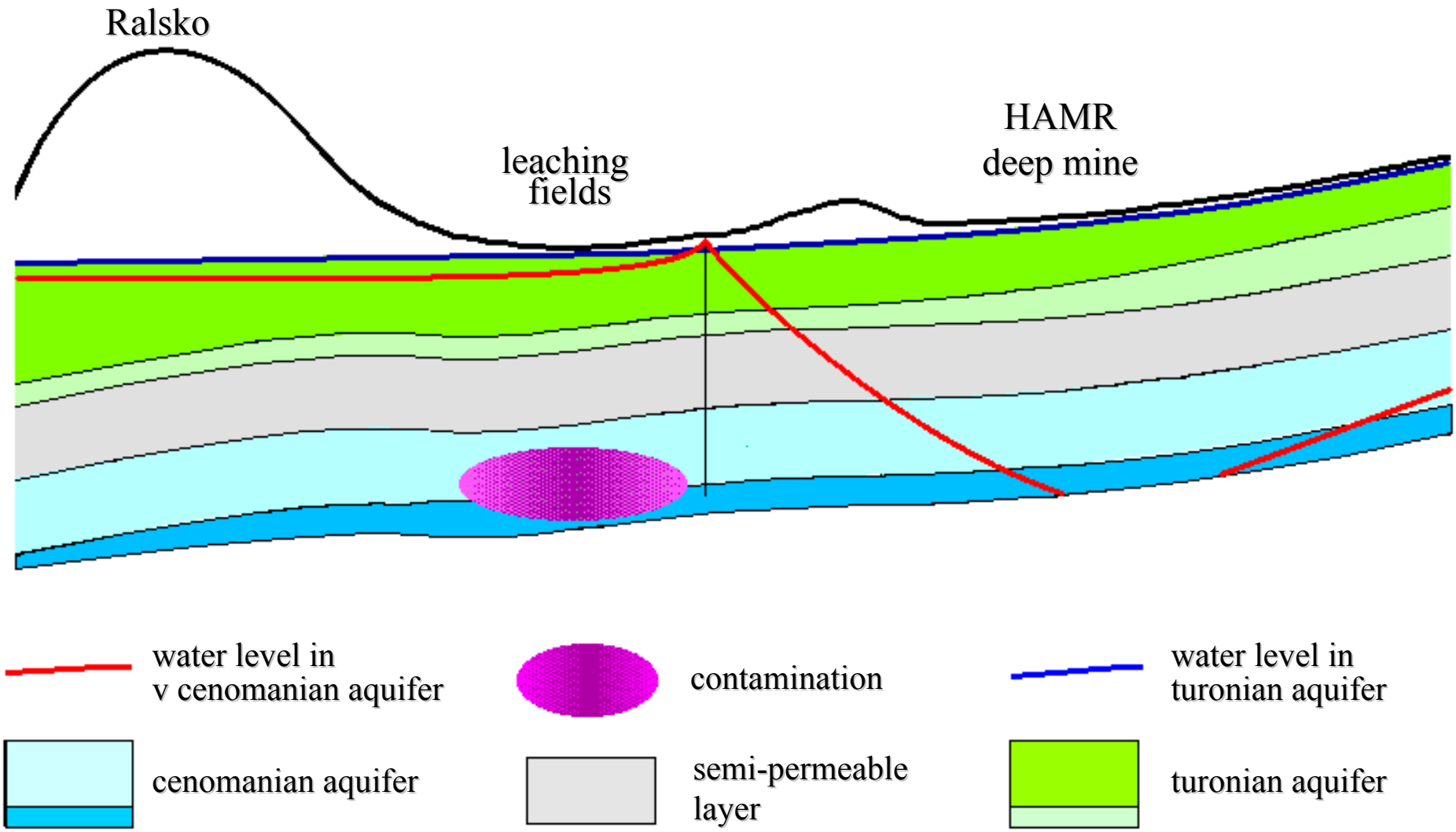
Piezometric heads

Before HB construction



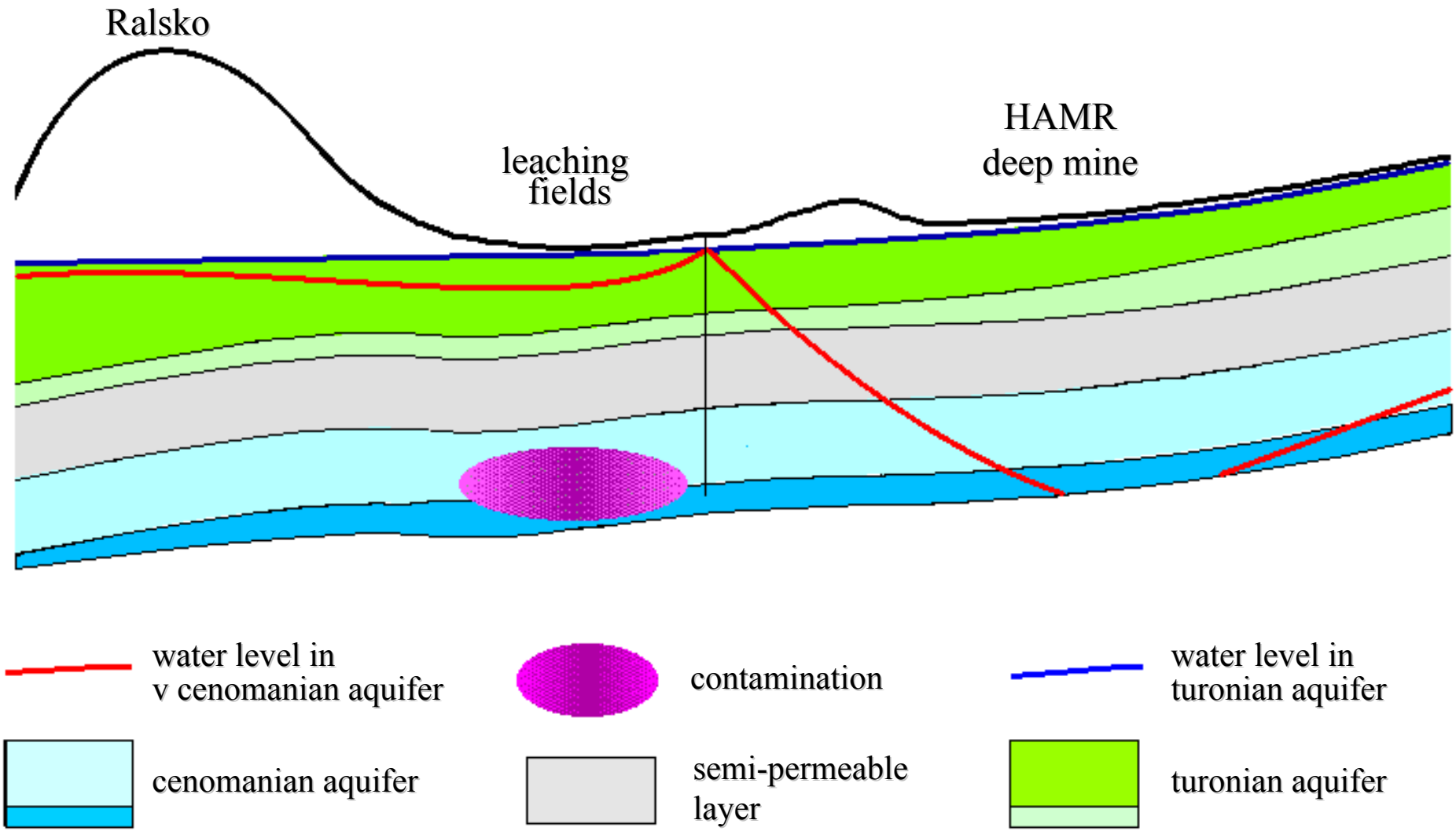
Piezometric heads

Before operation of evaporation station



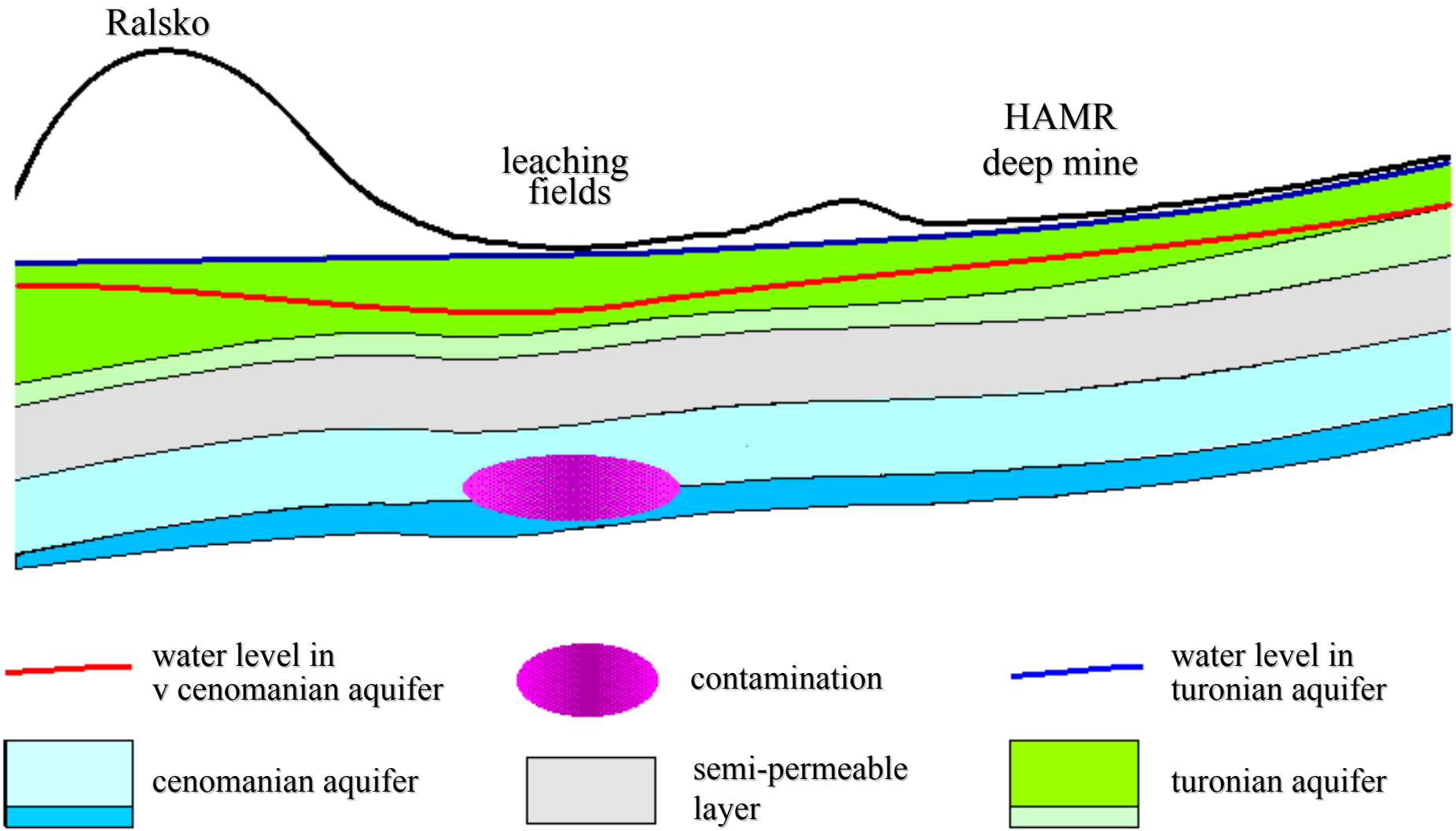
Piezometric heads

Current situation – evaporation station at work



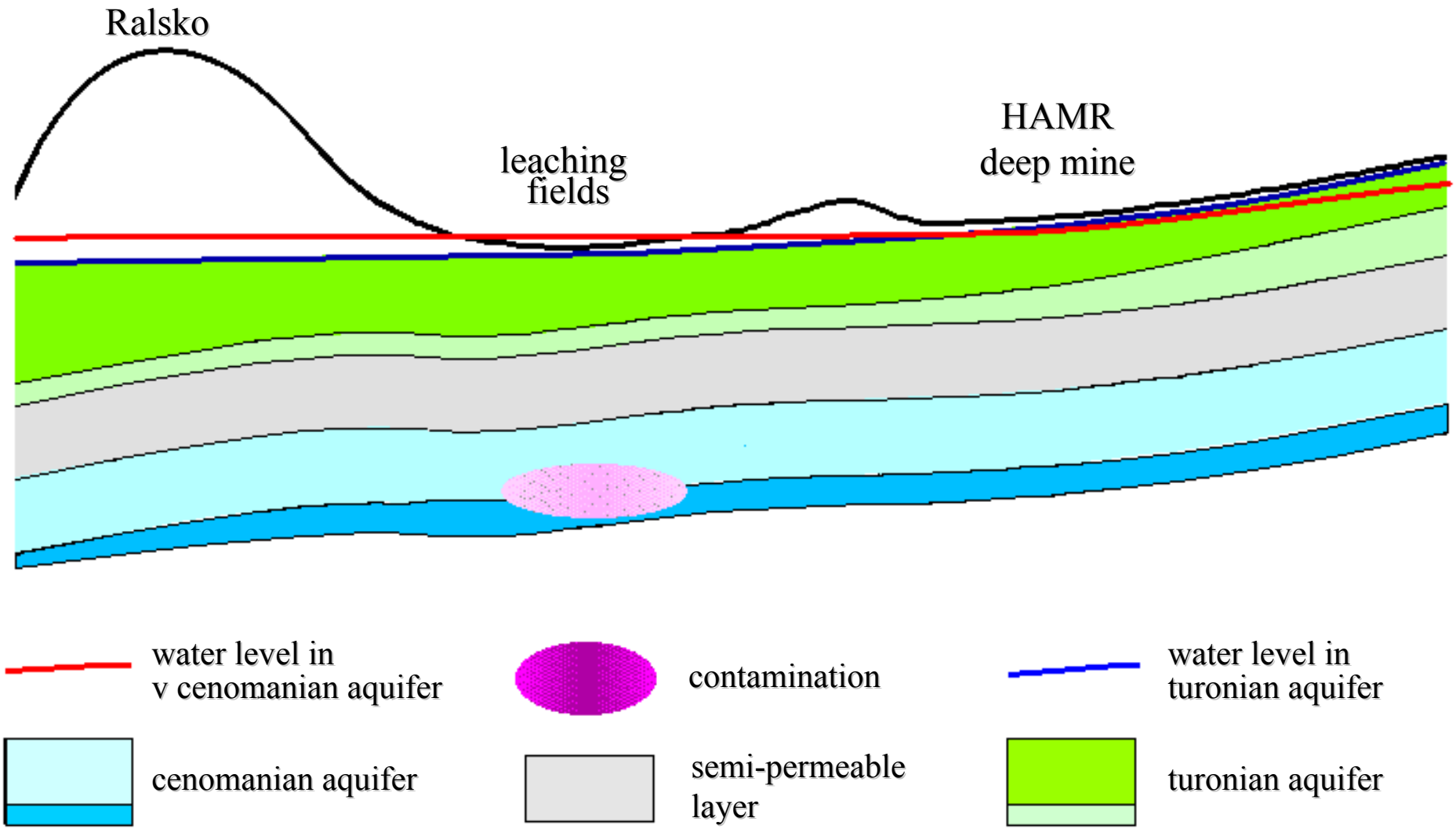
Piezometric heads

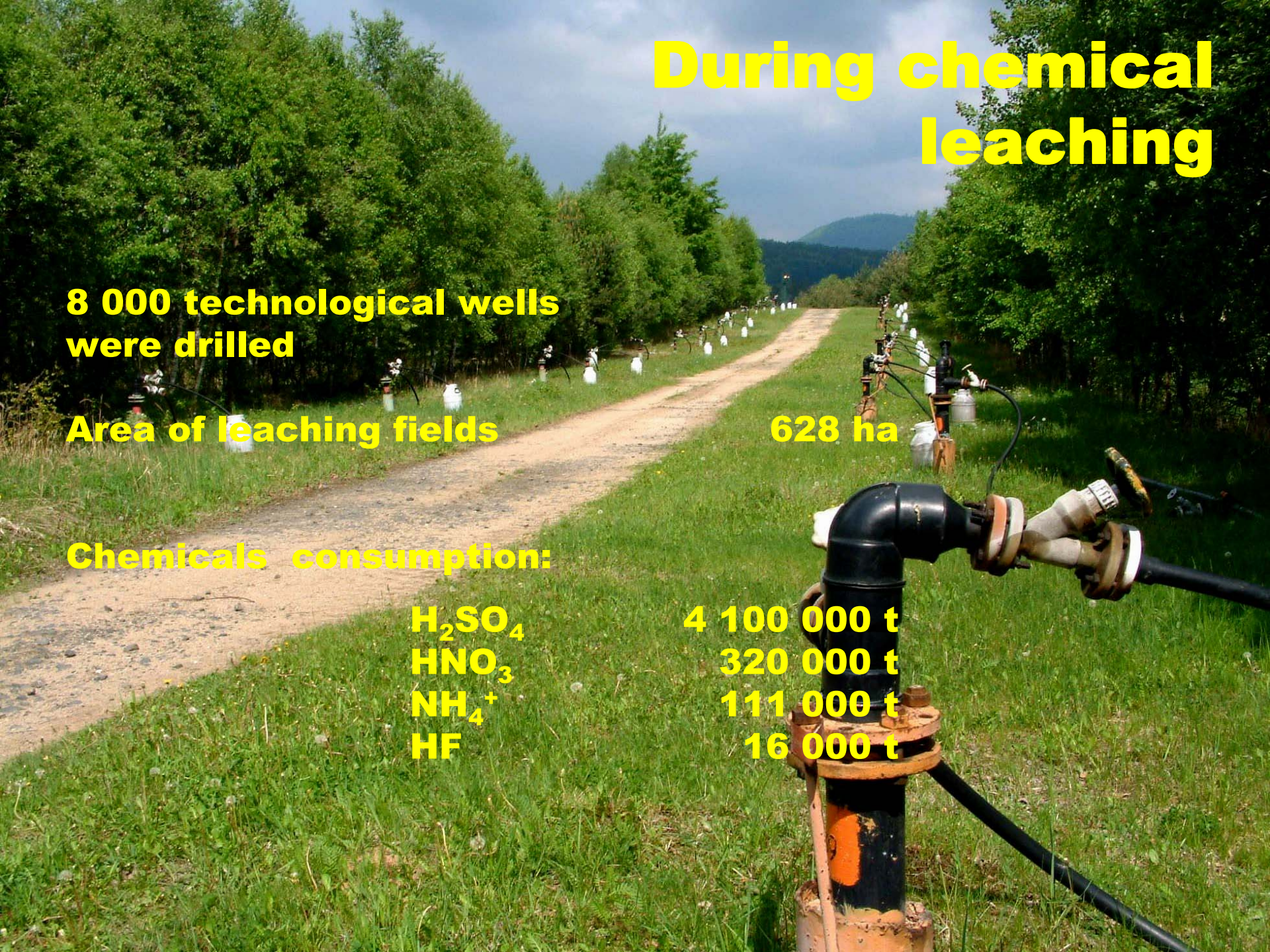
During remediation – Hamr mine flooded



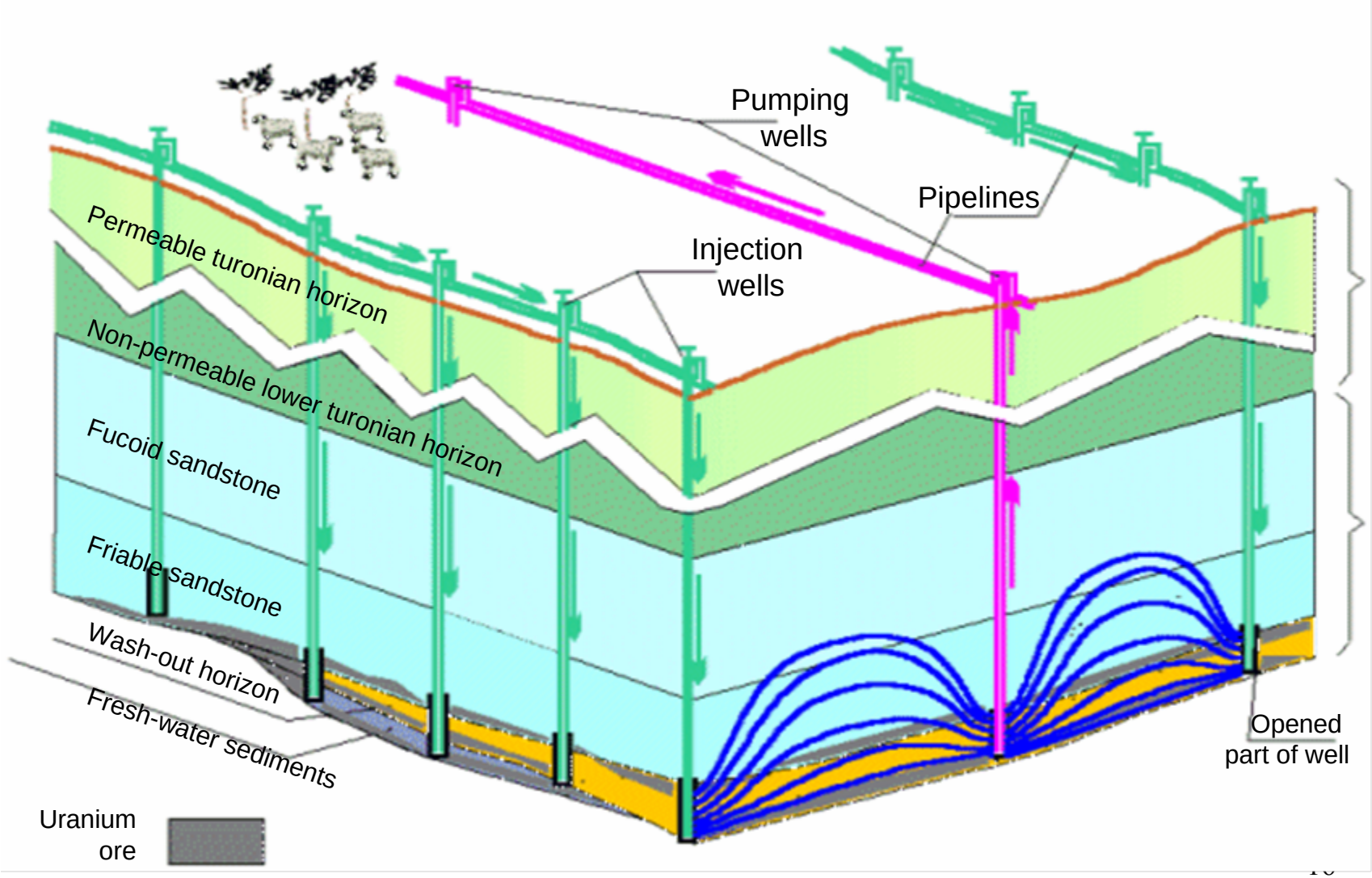
Piezometric heads

At the end of remediation process

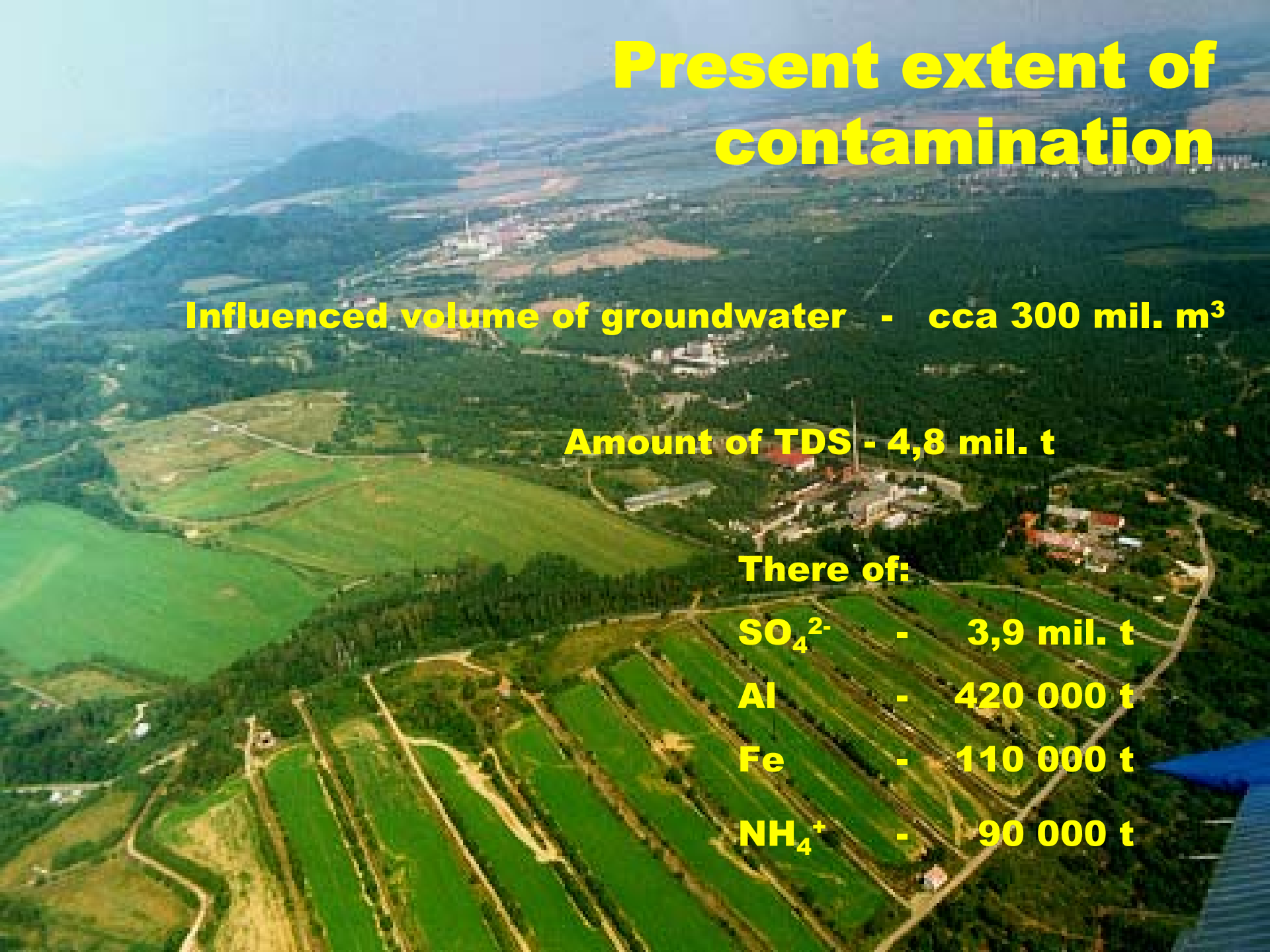



During chemical leaching
8 000 technological wells were drilled
Area of leaching fields 628 ha
Chemicals consumption:
H_2SO_4 4 100 000 t
HNO_3 320 000 t
NH_4^+ 111 000 t
HF 16 000 t

Scheme of leaching fields



Present extent of contamination



Influenced volume of groundwater - cca 300 mil. m^3

Amount of TDS - 4,8 mil. t

There of:

SO_4^{2-} - 3,9 mil. t

Al - 420 000 t

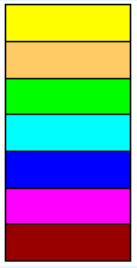
Fe - 110 000 t

NH_4^+ - 90 000 t

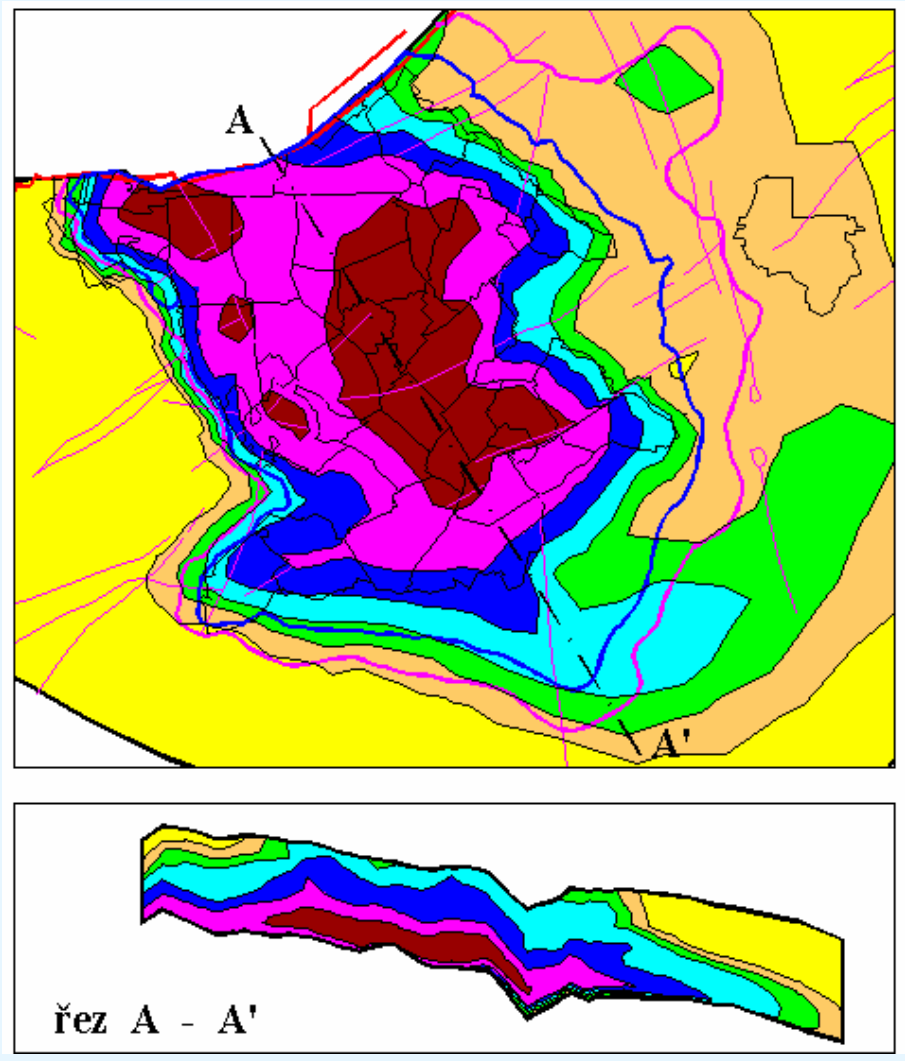
Present extent of contamination

Stráž fault
model boundary
tectonic lines
leaching fields
cross-section
3 g/l limit
8 g/l limit

TDS concentration [g/l]



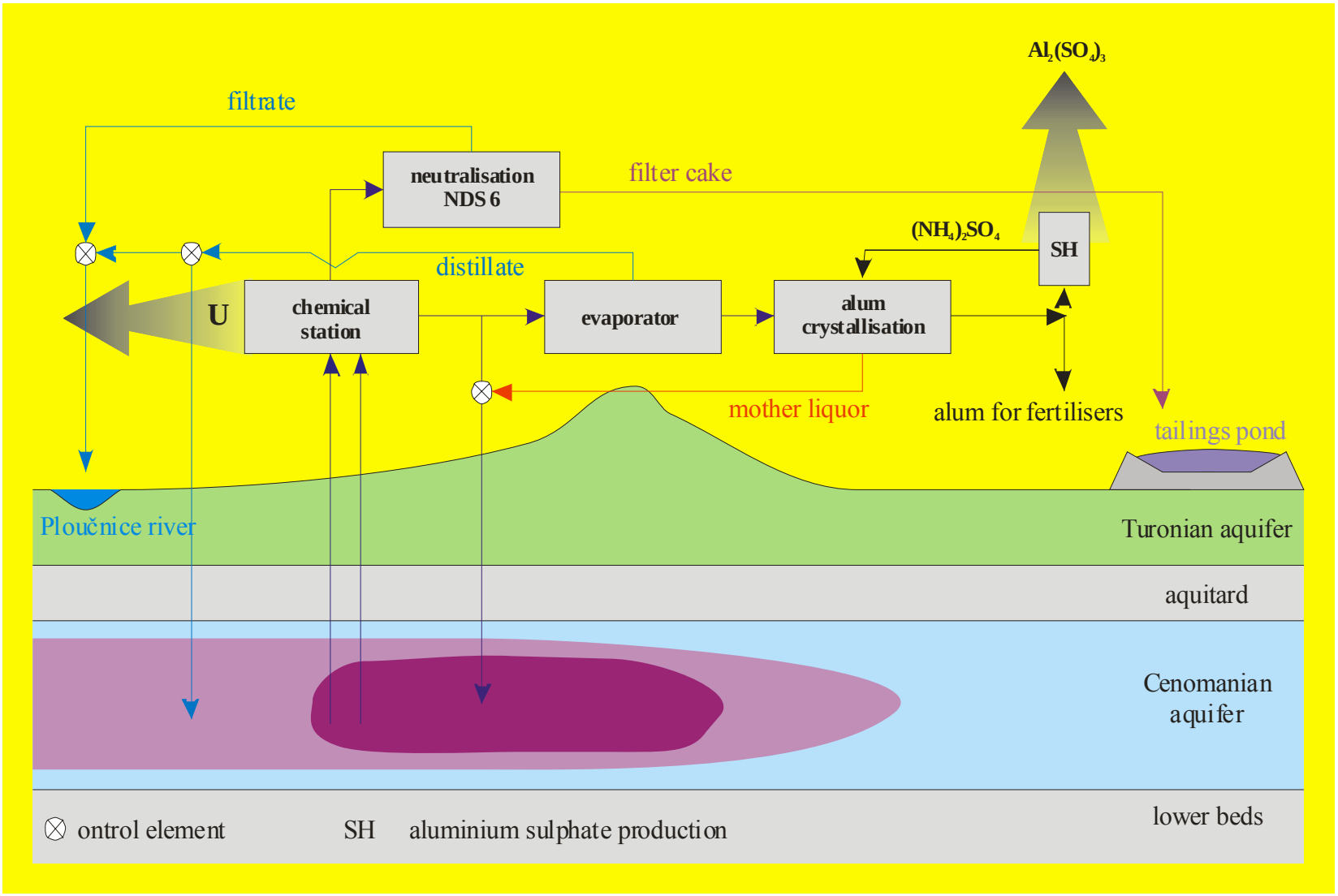
< 3
3 - 8
8 - 15
15 - 30
30 - 50
50 - 80
> 80



Reaching of safe state in the underground

From the ground it is necessary to remove cca 3,7 mil. t of contaminants

Scheme of present remedial technologies



Capacity of present remedial technologies

for withdrawing of contamination

Production and reprocessing of alum:
up to 35 000 t TDS per year

Neutralization:
up to 30 000 t TDS per year

Present remediation well net

End of remediation 2100

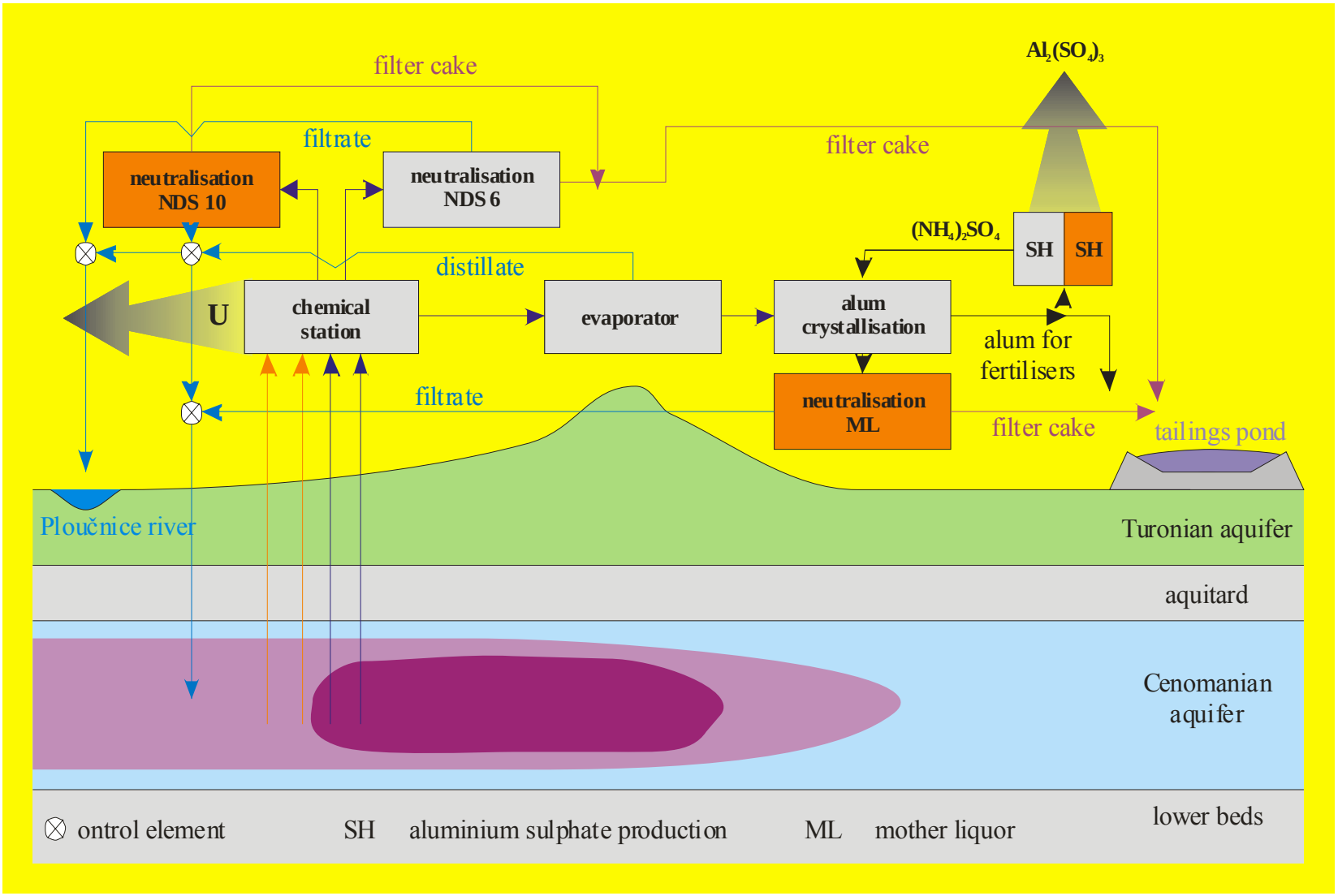
Realisation of new remedial technologies

II. stage of aluminium sulphate production
- end of 2007

Another neutralisation station
- end of 2012

Neutralisation of mother liquor
- end of 2009

Complete scheme of remedial technologies



Capacity of complete remedial technologies

for liquidation of contamination

Neutralisation:
up to 110 000 t TDS per year

Production and reprocessing of alum and mother liquor liquidation:
up to 80 000 t TDS per year

Completed remediation well net

End of remediation 2035

Thank you for your attention