

Improving the effectiveness of wells for lignite mine dewatering

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IMWA 2010 Mine Water & Innovative Thinking
 September 5 – 9, 2010
 Sydney, Cape Breton - Canada

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Wells in open pit dewatering

Deep drawdown, long screens,
 limited life span, permanent pumping

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Problem statement

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Problem statement

Investment in mine dewatering 60 million €/a
 operating wells: ~1,400
 new wells: ~ 180/a

Year of operation	Current output [%]	Shutdown [%]	Entrance loss [%]
0	50	0	50
1	48	2	50
2	45	5	50
3	42	8	50
4	38	12	50
5	35	15	50
6	32	18	50
7	28	22	50
8	25	25	50
9	22	28	50
10	20	30	50

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Problem statement

main influencing parameters

- pH-value
- oxygen
- (turbulent) flow velocities
- inbuilt material
- ground water composition
- bedrock composition
- microorganisms

exaggerated by
 frequently changing groundwater level
 aeration and re-wetting of pyrite containing sediments

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Fe-Oxides

Fe(III)-Oxides

Ferrihydrite	$Fe_5HO_8 \cdot 4H_2O$
Goethite	$\alpha\text{-FeOOH}$
Lepidocrocite	$\beta\text{-FeOOH}$
Akaganéite	$\gamma\text{-FeOOH}$
Schwertmannite	$Fe_8O_8(OH)_6SO_4$
Hematite	$\alpha\text{-Fe}_2O_3$

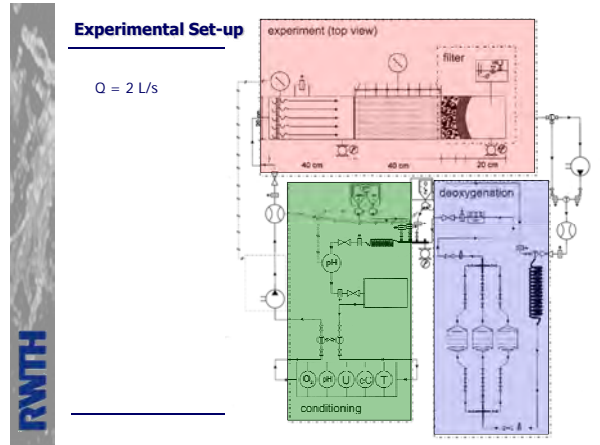
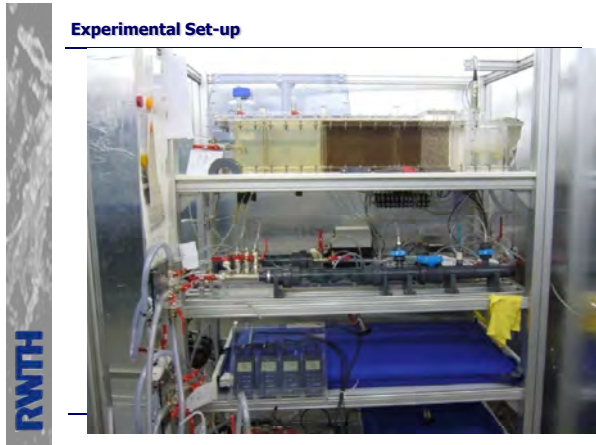
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Fe-Oxides

Formation of different oxides

Cornell & Schwertmann (2003)

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Experimental Set-up

Fe(II) solution

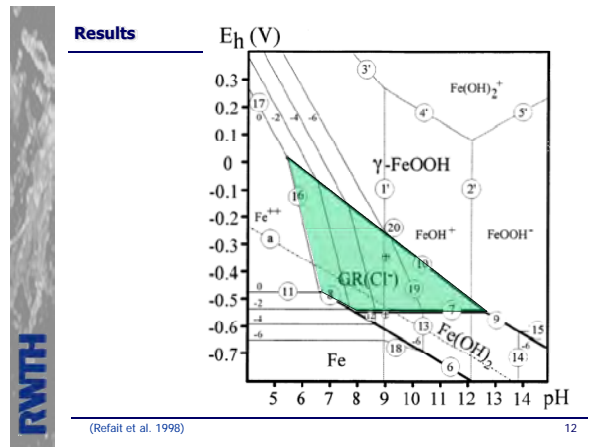
~~Sulfate ?~~
~~Nitrate ?~~
~~Carbonate ?~~

Hydroxide ?

MIYAMOTO (1976)
 Fe(II)-sulfate with NaOH to pH 8
 stirre 7 h at 70 °C

REFAIT et al. (1998)
 0.23 M Fe(II)-chloride
 with 0.4 M NaOH

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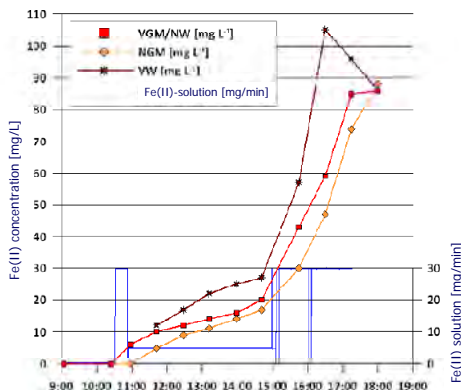
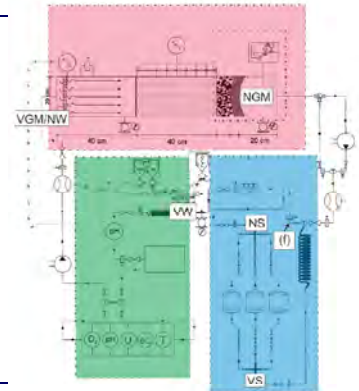
Preparing oxygen free water

	O ₂ [mg/L]	O ₂ reduction [%]
Deionized water	8.3	
Stirring	2.4	71
Boiling	1.5	82
Vacuum	0.6	93
bubling with N ₂ , 4h	0.1	99

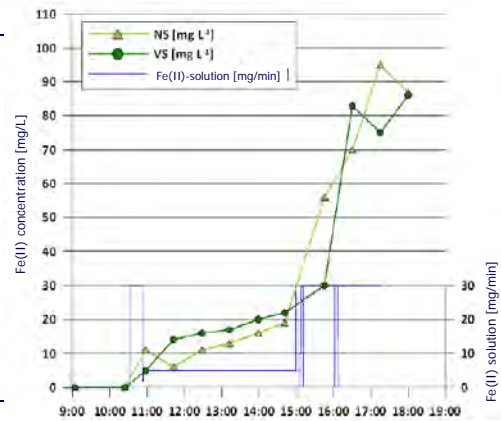
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Results



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Summary

- actual solution to well loss and ageing
drill more wells
- parameters known
comprehensive theory not
- closed circuit expermental set-up
complex control
- starting solution from Fe(II)-hydroxide
possible, amount not sufficient
- iron hydroxide formation in the filter
gained

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