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Chair in Mine Water Remediation & Management

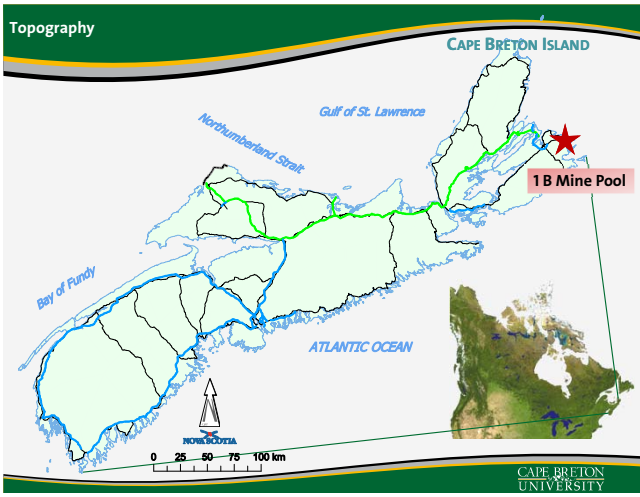
TRACER TEST IN A SETTLING POND

The Passive Mine Water Treatment Plant of the 1 B Mine Pool
Nova Scotia, Canada

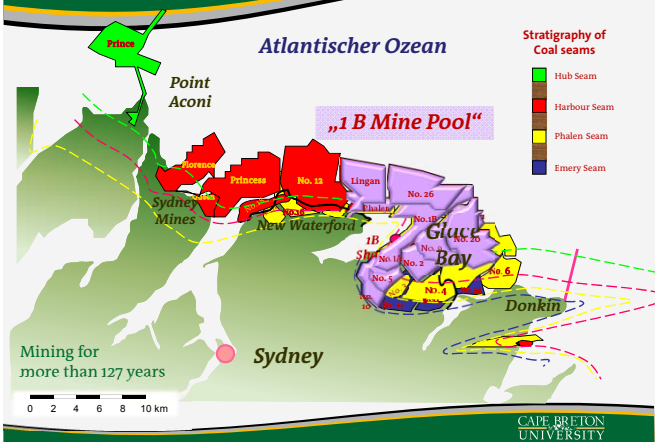
Content

- Topography
- Problem
- Results
- Interpretation
- Conclusions

Topography



Regional Overview



Problem and Question

- „Why are the design criteria of the settling pond in the passive treatment system of the 1B mine pool not met?“
- Design Criteria:
  - Fe_{tot} at point of discharge < 1 mg L^{-1}
  - Minimal residence time: 15–18 hours
  - Low filter residue (which means low iron oxide content in discharge water)

Problem and Question

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Problem and Question

Parameter	Inflow	Outflow	Units
Fe_{tot}	6.0	3.3	mg L^{-1}
Mn	8.0	7.6	mg L^{-1}
Al	1.1	0.6	mg L^{-1}
O_2	42.5	94.5	%
pH	7.7	7.0	mg L^{-1}
k_B ('acidity')	1.4	0.22	mmol L^{-1}

Data from April and May 2009
$n = 9$; O_2: $n = 24$

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Problem and Question

- Neville Street Pump Field
  - 10 wells in the northern and southern field
  - 5 wells in the western field (not used)
- Characteristics of the 1 B Mine Pool
  - 76 million m^3 of total mine water
  - Mean pump rate 7–11 m^3 / min
  - Mine water level is 5 m below seal level
  - Set up ensures that no uncontrolled mine water discharges into the marine environment occur

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Problem and Question

1 B Schacht November 1994

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Methods

- Two independent tracer tests
  - 1: 250 g Na-Fluorescein ("Uranine") ↦ Cascade
  - 2: 250 g Rhodamine B ↦ Cascade &
    500 g Na-Fluorescein ↦ well
  - Dirac impulse injection
- Measurements
  - On-site Fluorimeter
  - Laboratory (Spectro-fluorimeter)
  - On-Site-Parameters (e.g. pH, k_B, k_A, RedOx, O_2)

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How did we do it?

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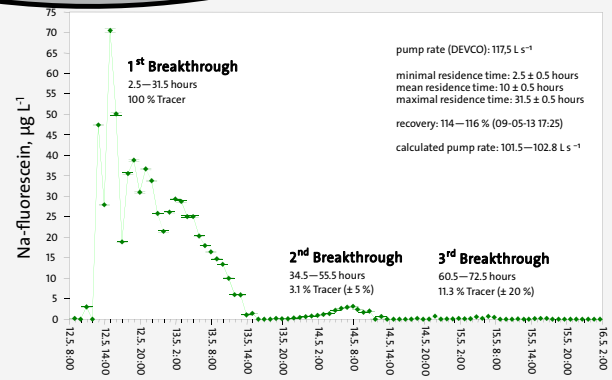
Results



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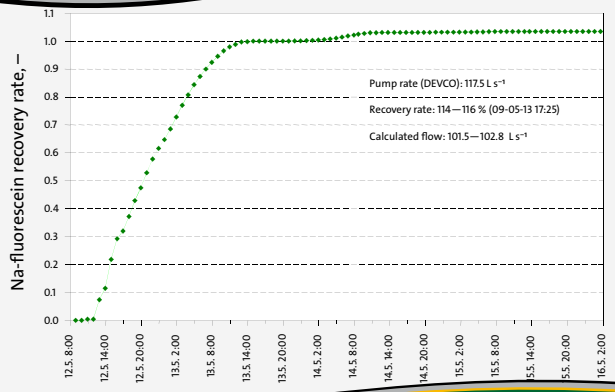
Results



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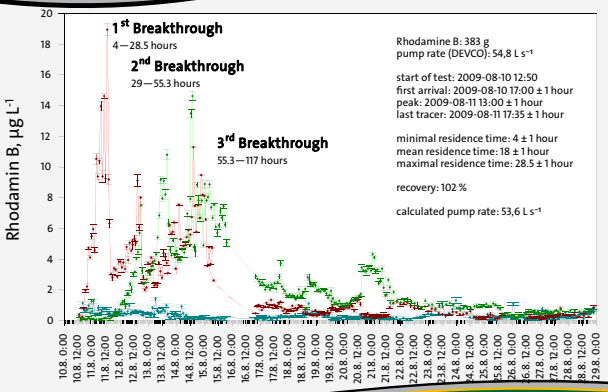
Results



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Interpretation

- Mean residence time
  - 10 – 18 hours (100 – 50 L s^{-1}) √
- but:
  - 50 % below 10 – 18 hours and …
- Minimal residence time
  - Just 2 – 4 hours
- Consequently, the hydrolysed iron has not enough time to settle in the settling pond
- Result:
  - Elevated Fe_{tot}-concentrations and "red" water in discharge

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Conclusions and … bad luck

- Na-Fluorescein und Rhodamine B are good tracers for mine water
  - ensure that tracer concentration is below visibility limit at point of discharge!!!!!!
- Need for 1B settling pond:
  - minimal residence time must be increased
- Installation of baffle plates (plastic planes)
- Five baffle plates were installed
- No results yet – why?
- Heavy storm at the beginning of the year ripped of the baffle plates' cemented anchors

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Thanks to ...

- Martina Ueckert
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The End!

Walter Moers Stollentroll

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