

Tailings Surface Cover Development Through Integration of Reactive Phosphate and Organic Matter

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Heterotroph Oxygen Requirements

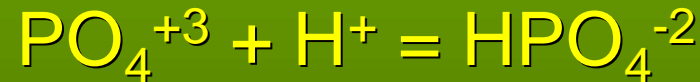
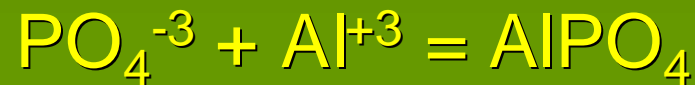
- Heterotroph Population:
 10^7 /g tailings
- Oxygen required by the population:
 $175 \mu\text{L/g}$ tailings
- Oxygen in tailings estimate:
 $< 20 \mu \text{L/g}$ tailings



Selbaie fresh tailings vegetation plots



Simple Phosphate Chemistry



Field Experiments Set-Up 1993

➤ INCO

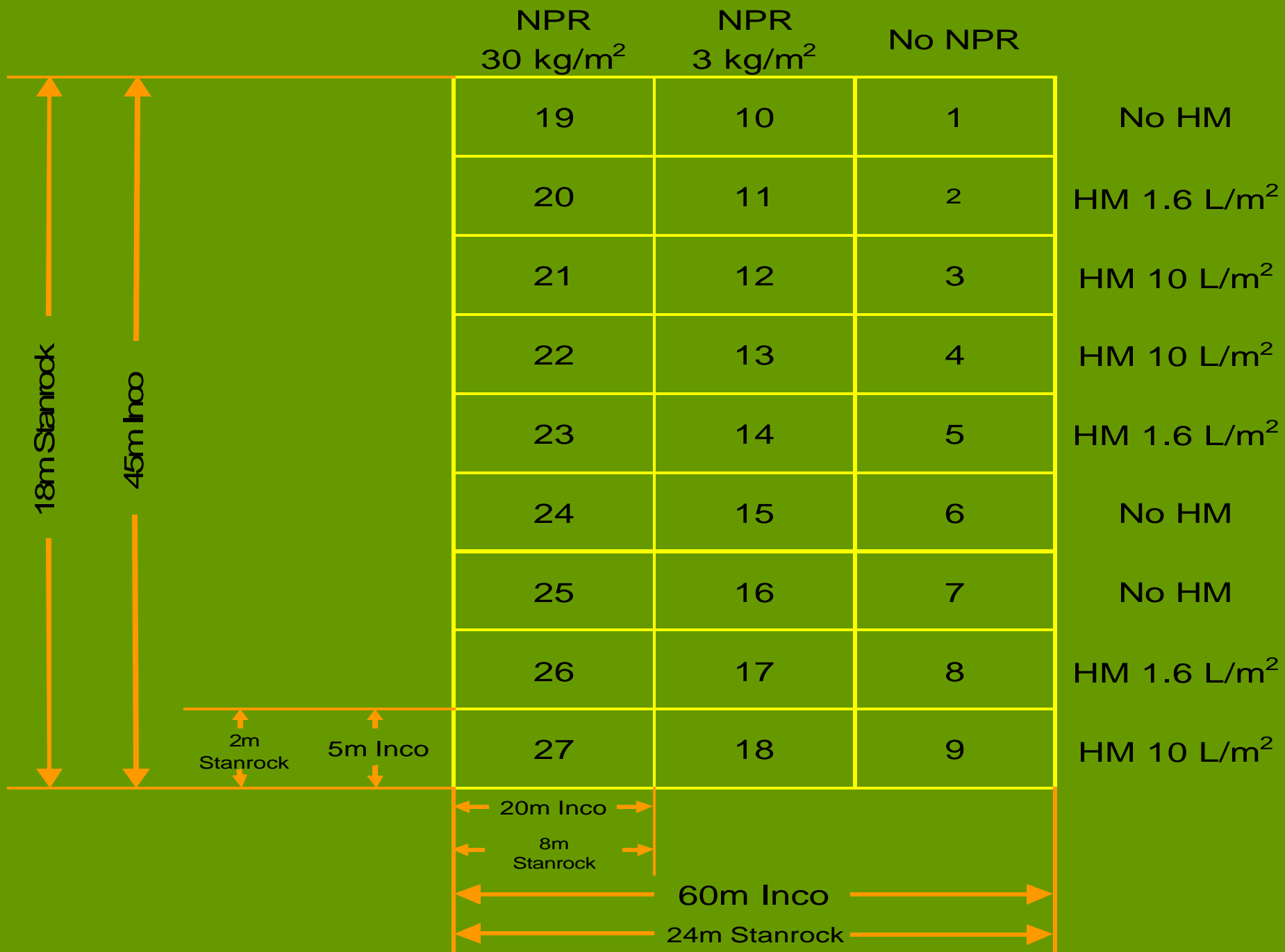
On fresh pyrrhotite tailings

0.5 ha plot

➤ Stanrock

On 30-year old uranium tailings

0.13 ha plot



Stanrock plots set-up



Field investigations

- In-situ leachate / porewater water collection
- Collected at set up 1993, after 6months and 4 years, respectively
- EM - Conductivity (Geonics EM31 and EM38) after 3 years
- Resistivity survey (Inco only) after 4 years
- Tailings samples from various depth after plot set up and 4 years, respectively

Stanrock: High Horse Manure and NPR



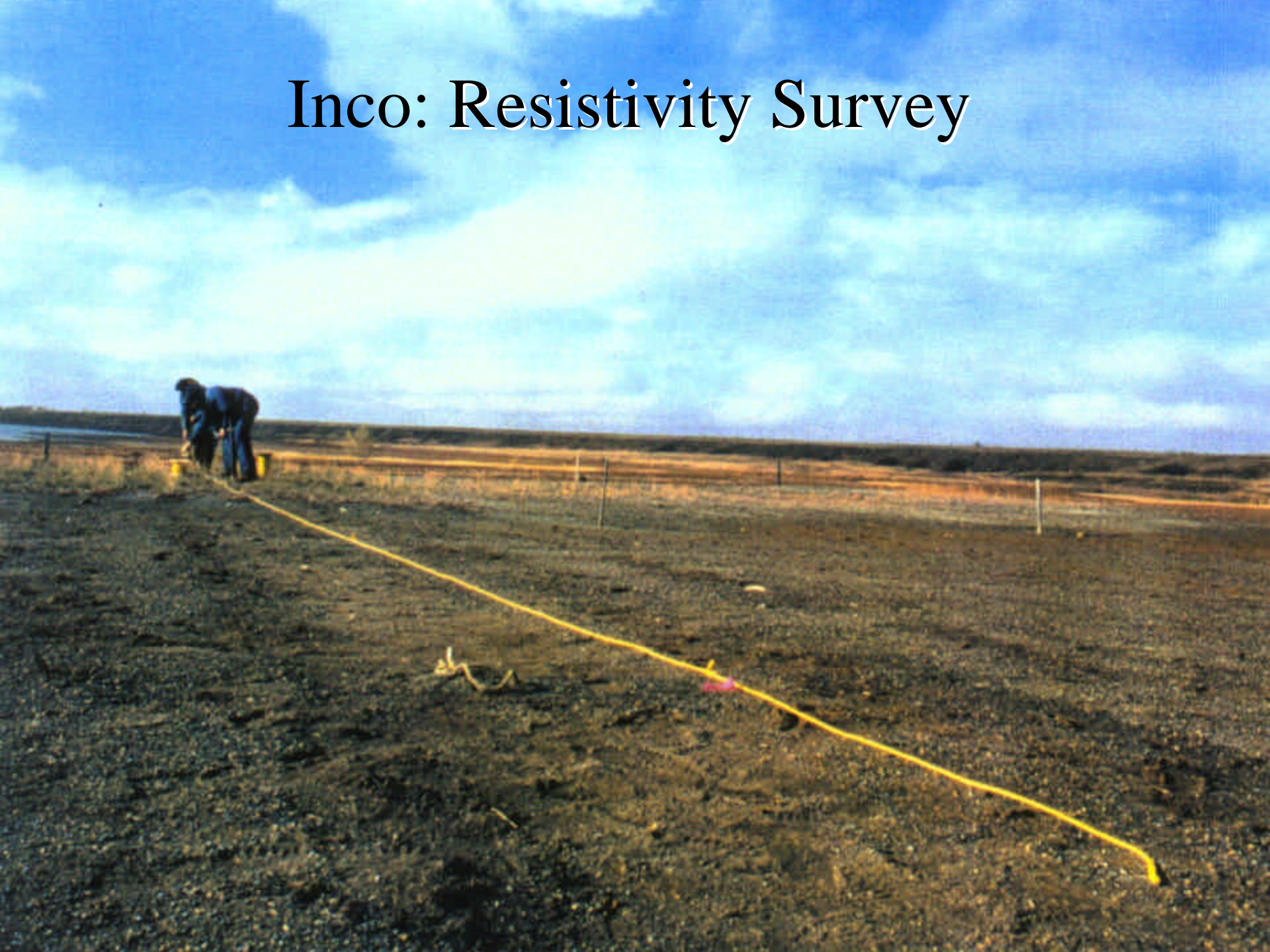
Stanrock: Geonics EM31 and EM38



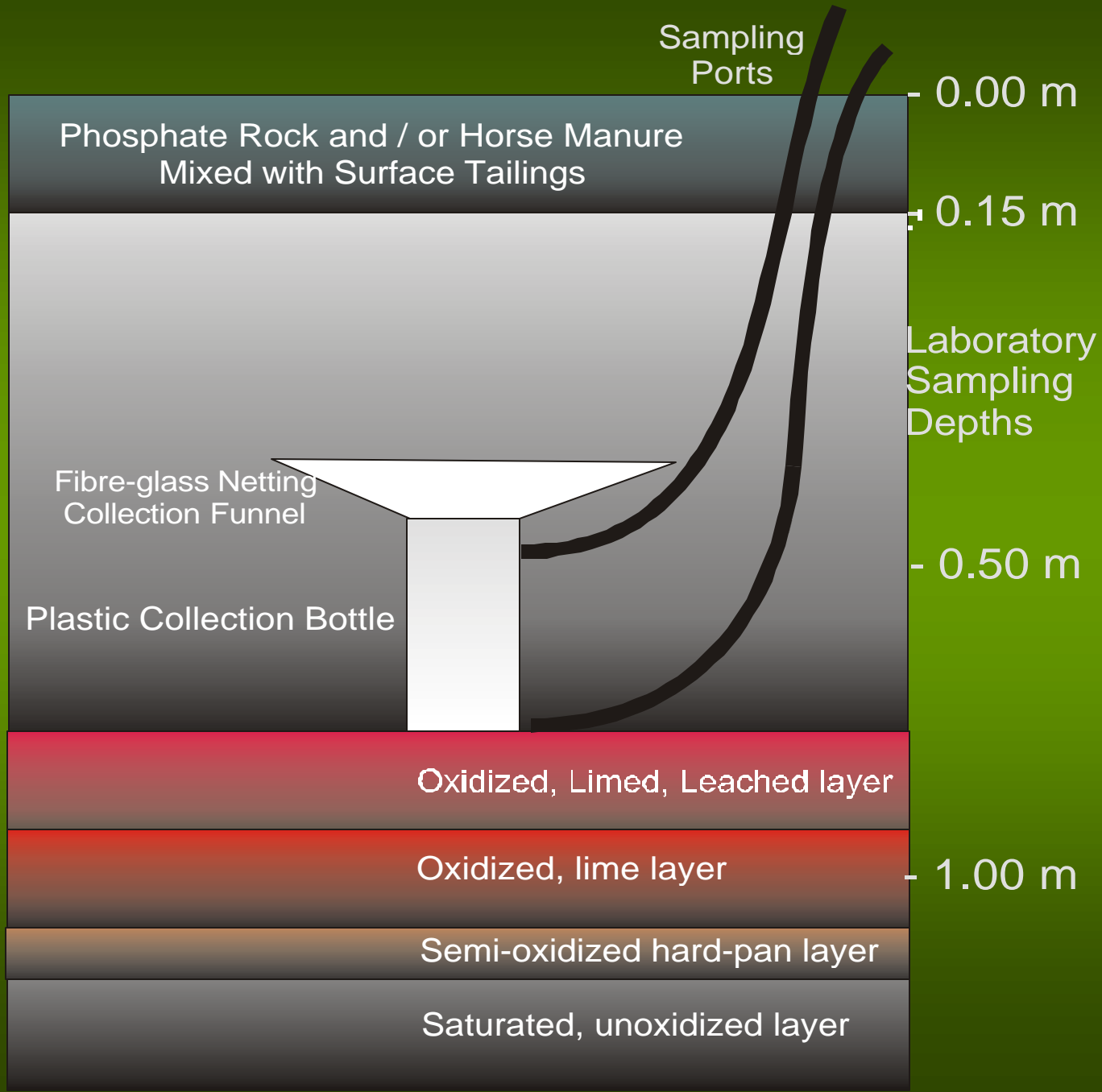
Inco: Resistivity Survey



Inco: Resistivity Survey



Leachate Collection Device



Results From Field Leachate Collectors

Stanrock

- Acidity background of porewater 7,570 – 28,073 mg/l CaCO₃
- After 6 month, acidity of porewater: 1,467 – 18,657 mg/L CaCO₃
- After 3.5 years, acidity of porewater: 546 – 22,236 mg/L CaCO₃
- Lowest value in high NPR plots

Inco

- After 6 months, dry no leachate
- After 3.5 years, acidity of porewater: 47 – 7,777 mg/L CaCO₃
no relationship to treatments
- Large variability funnel area 0.018 m²



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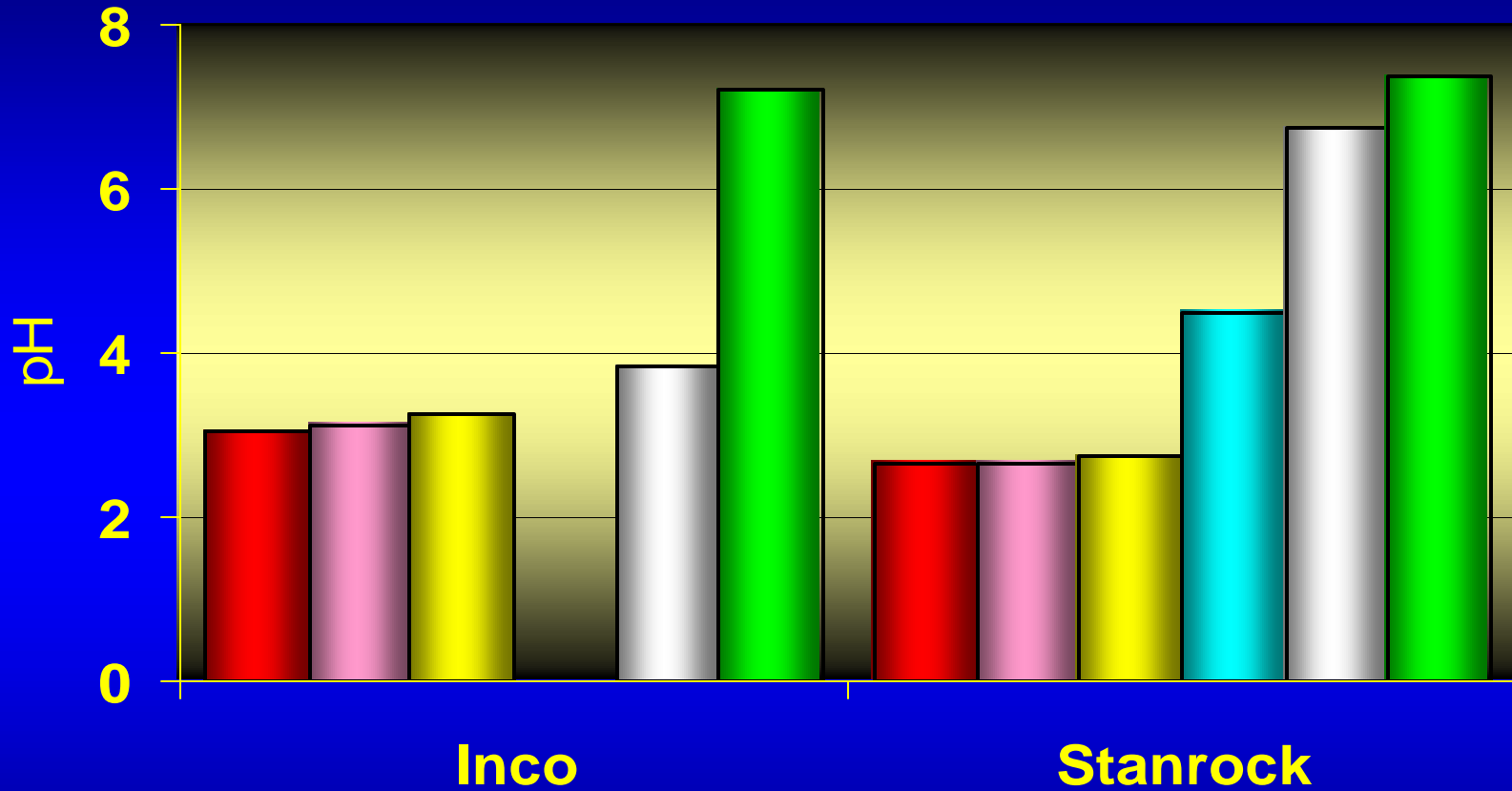


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Laboratory Investigations

- Tailings slurries six years after set up
- 40 g in 200 ml distilled water
- Monitored slurries after stirring 1 h, 1 week, 18 month, 21 month
- Worst case scenario at room temperature covered completely

Pore water pH, 0-15cm



Control

NPR, 3 kg/m²

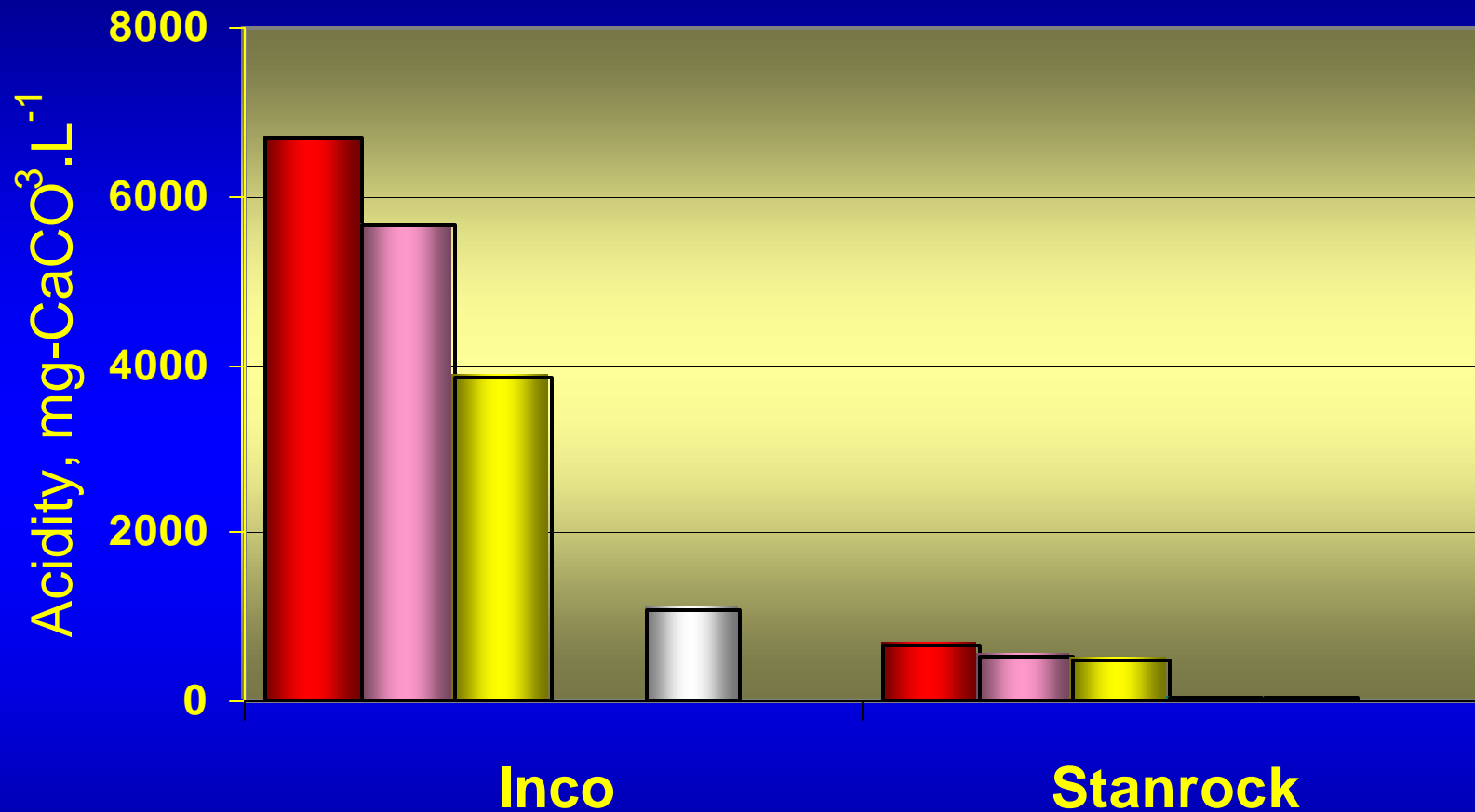
NPR, 30 kg/m²

HM, 10L/m²

NPR, 3 kg/m² & HM, 10 L/m²

NPR, 30 kg/m² & HM, 10L/m²

Pore water acidity, 0-15cm



Control

NPR, 3 kg/m²

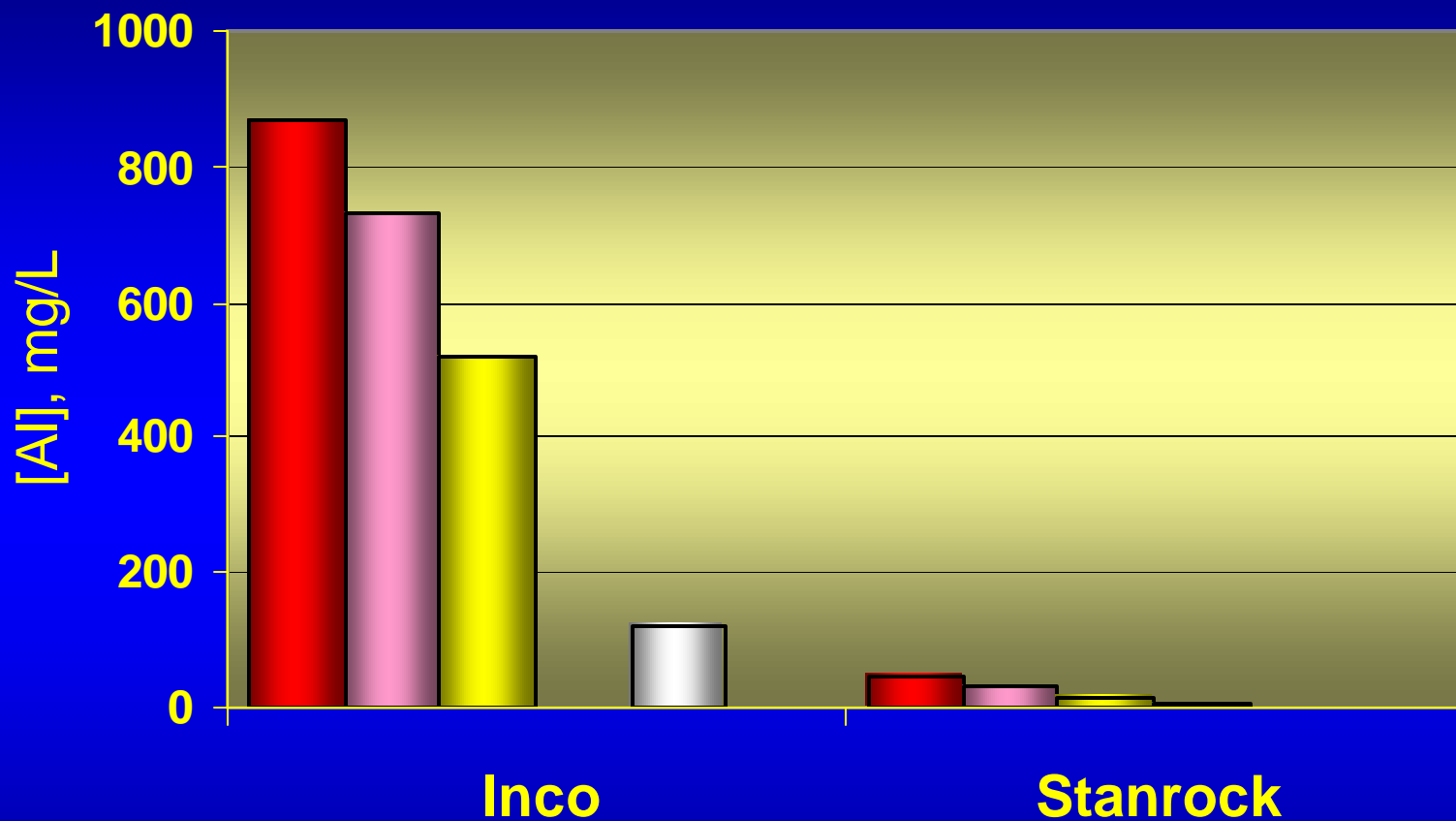
NPR, 30 kg/m²

HM, 10L/m²

NPR, 3 kg/m² & HM, 10 L/m²

NPR, 30 kg/m² & HM, 10L/m²

Pore water [Al], 0-15cm



■ Control

■ NPR, 3 kg/m2

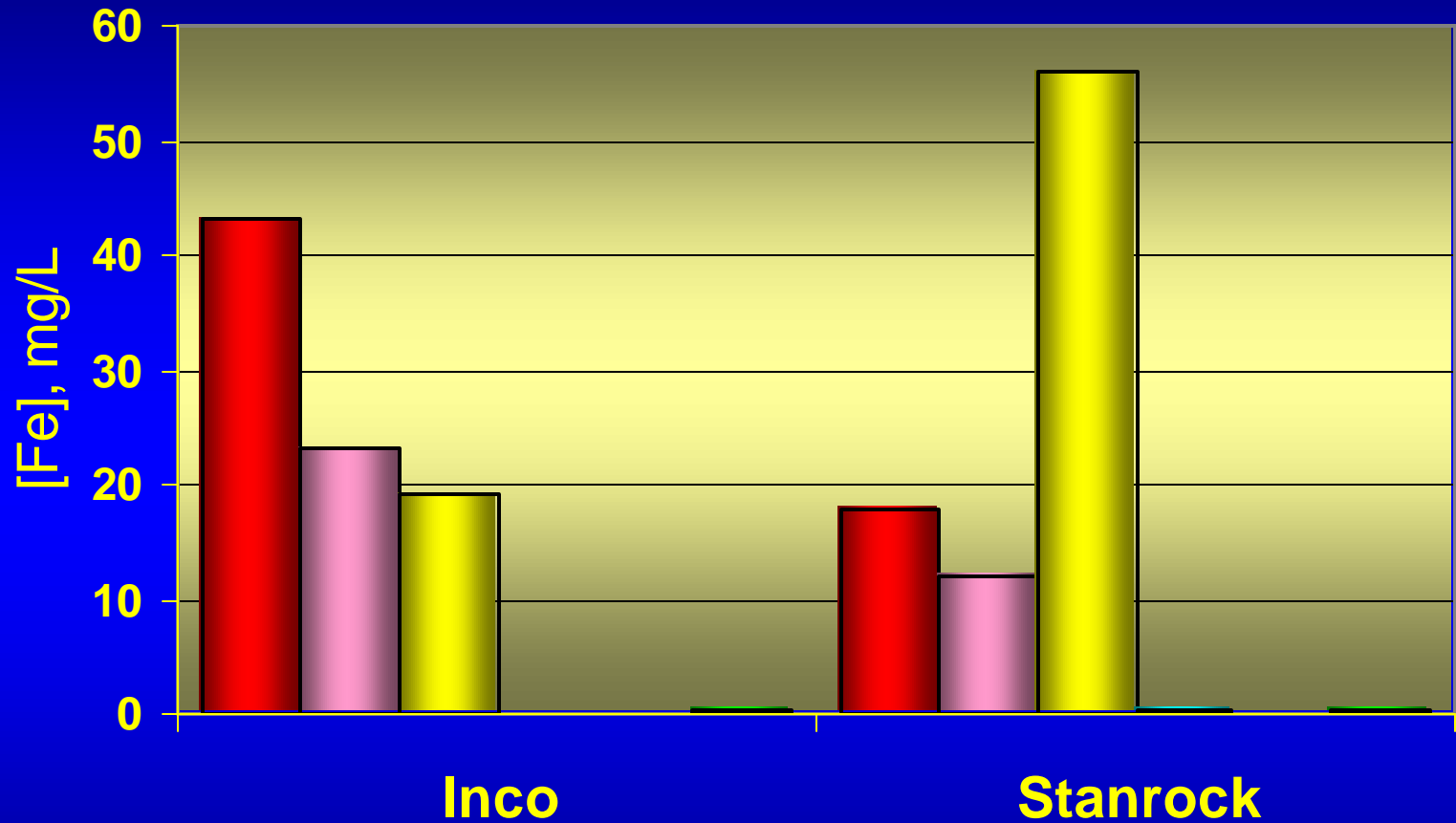
■ NPR, 30 kg/m2

■ HM, 10L/m2

■ NPR, 3 kg/m2 & HM, 10 L/m2

■ NPR, 30 kg/m2 & HM, 10L/m2

Pore water [Fe], 0-15cm



Control

NPR, 3 kg/m2

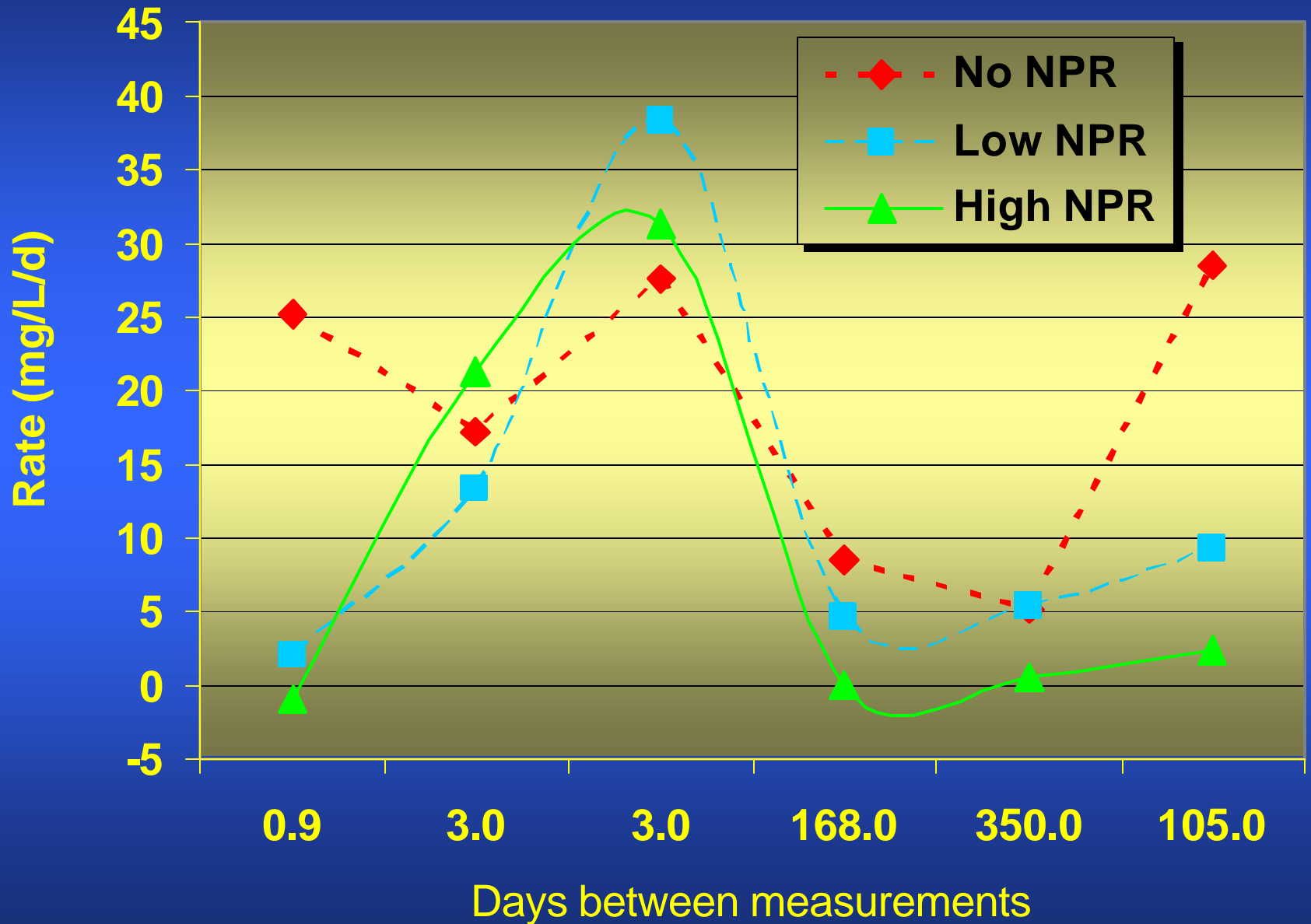
NPR, 30 kg/m2

HM, 10L/m2

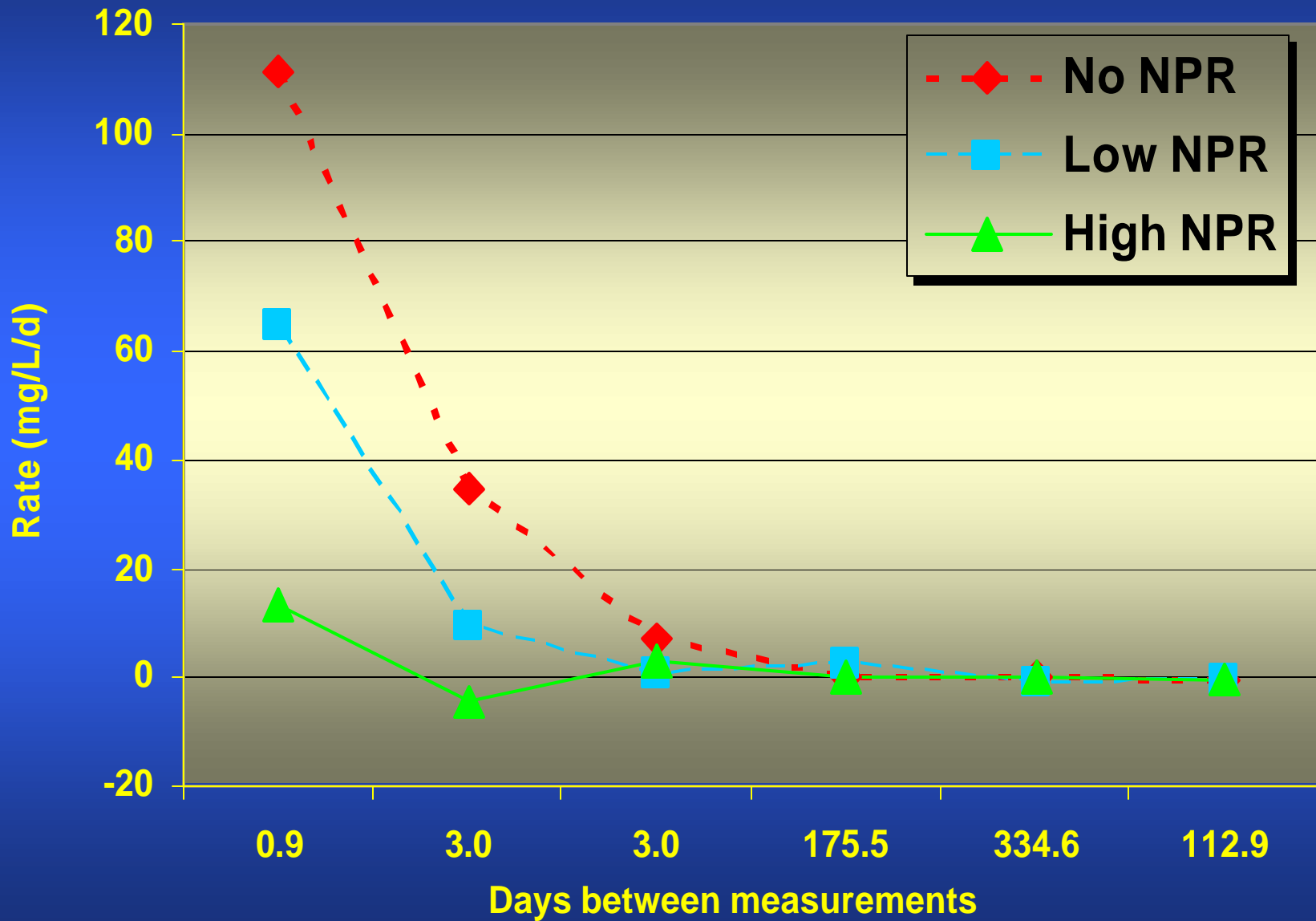
NPR, 3 kg/m2 & HM, 10 L/m2

NPR, 30 kg/m2 & HM, 10L/m2

Rate of Acidity Chages, Inco



Rate of Acidity Change, Stanrock



NPR
Might Be
A Solution