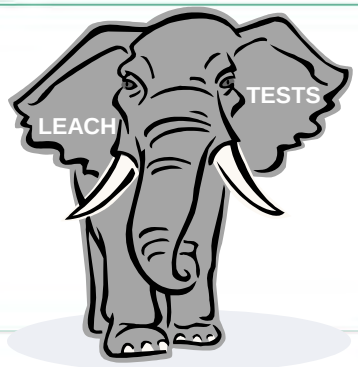
Terry Harck

# Mobilisation of salts from mine waste. A pinch or a pound?

## The Elephant in the room






## Leach tests



## Leach tests

| Test method | Liquid to solid ratio (by mass) |
|---|---|
| USEPA1312 | 20:1 |
| DWAF (1999) | 20:1 |
| Price (1997) | 3:1 |
| Modified ASTM D3987 | 4:1 |
| Nevada Mining Association (1996) | 1:1 (for crushed rock) |



## South Africa

- Semi-arid
- 600 mm to 700 mm rainfall per year
- Drainage salinity is of concern

- How should leach tests be used to assess the salinity load from gold tailings?



## Method

- Auger holes
- Composite samples:
  1 – 2 m ,
  5 – 6.5 m,
  15 – 16.5 m,
  27 – 28.5 m
- Saturated layer at the base where holes collapsed

## Method

- Leach tests at a range of L/S: 20, 10, 5, 2, 0.3
- Leachate analysed for:
  - Na, K, Ca, Mg
  - Cl, $SO_4$, Alkalinity
  - Si, Fe

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## Gold tailings

- Quartzite host rock
- Tailings composition:
  - $SiO_2$
  - ±1% pyrite
  - Minor chlorite, mica, feldspar

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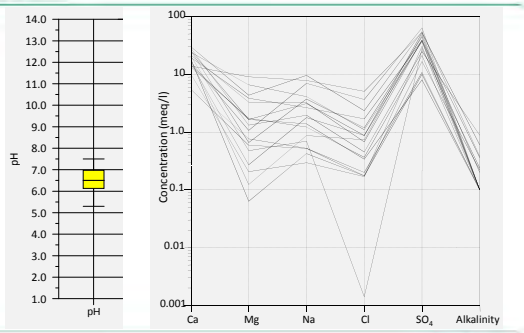
## Results - summary

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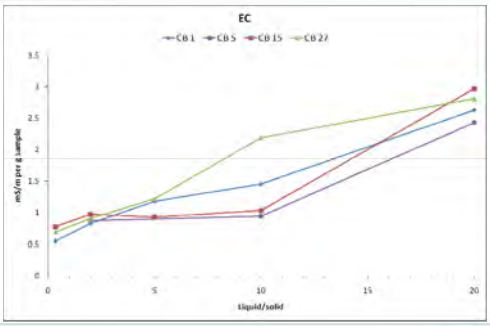
## Results - salinity

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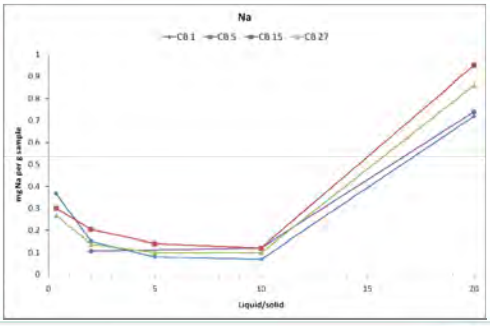
## Results - cations

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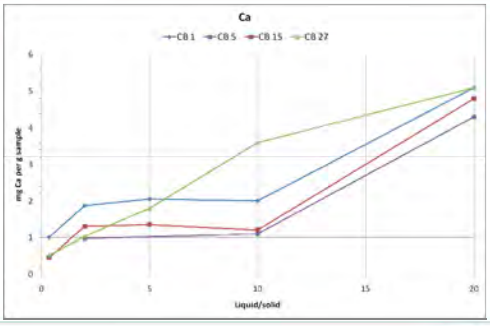
## Results - cations

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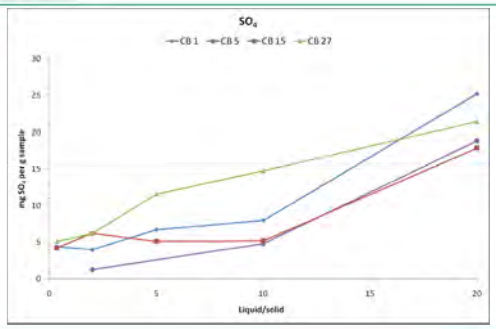
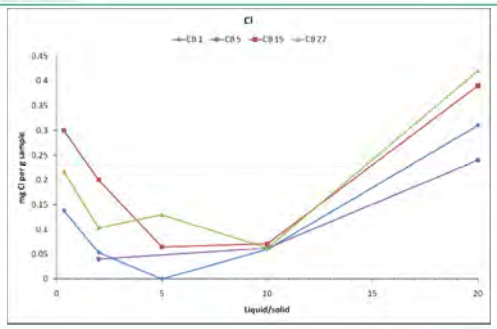
## Results - anions






## Results - anions






## Findings

- Leachability not linear, not proportional to L/S

- Nature of the sample
- Particle size
- Chemistry of the liquid
- Residence time
- Number of repetitions
- Degree of agitation
- Method of analysis
- Liquid to solid ratio



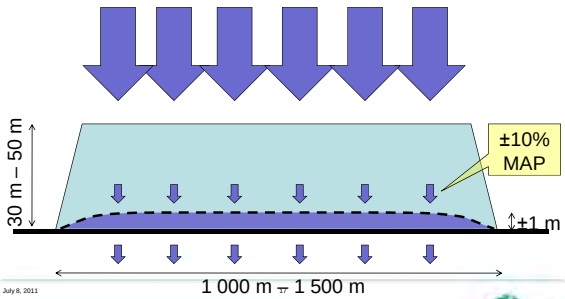
## Findings

- An L/S of 20 will overestimate the mobilisable salt load

- Porosity of silt 35% to 50%
- On saturation L/S of 1:3 (0.3) or less



## Conceptual model






## Summary

- Leachability is not a linear function of L/S
- Cannot scale 20:1 L/S to field conditions to obtain estimate of drainage quality
- Using L/S of 20, such as required by DWAF (1999) could overestimate leachability by 3 to 10 times
- Using L/S of ±1 is consistent with conceptual model developed from field observations
- “Practical” to use L/S in range of 2 to 10

## Thank you

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