Resource Recovery and Remediation of Alkaline Wastes

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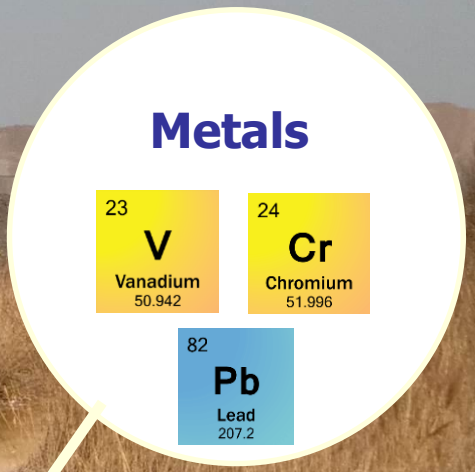
NERC SCIENCE OF THE ENVIRONMENT

Alkaline wastes /residues

~ 1 billion tonnes globally p.a.

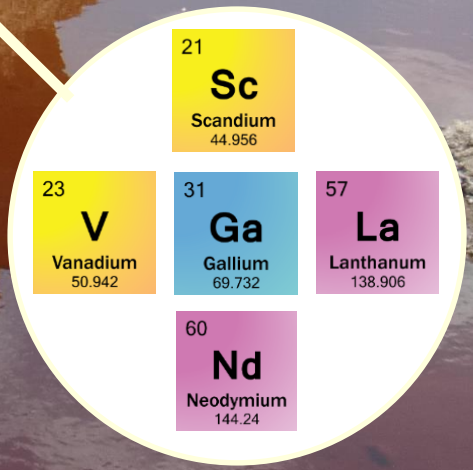
Gomes et al. (2016) J. Clean. Production 112: 3547

Environmental liabilities



Gomes et al. (2016) J. Clean. Production 112: 3547
Mayes et al. (2016) J. Sustain. Metall. 2: 332.

Opportunities



Gomes et al. (2016) J. Clean. Production 112: 3547
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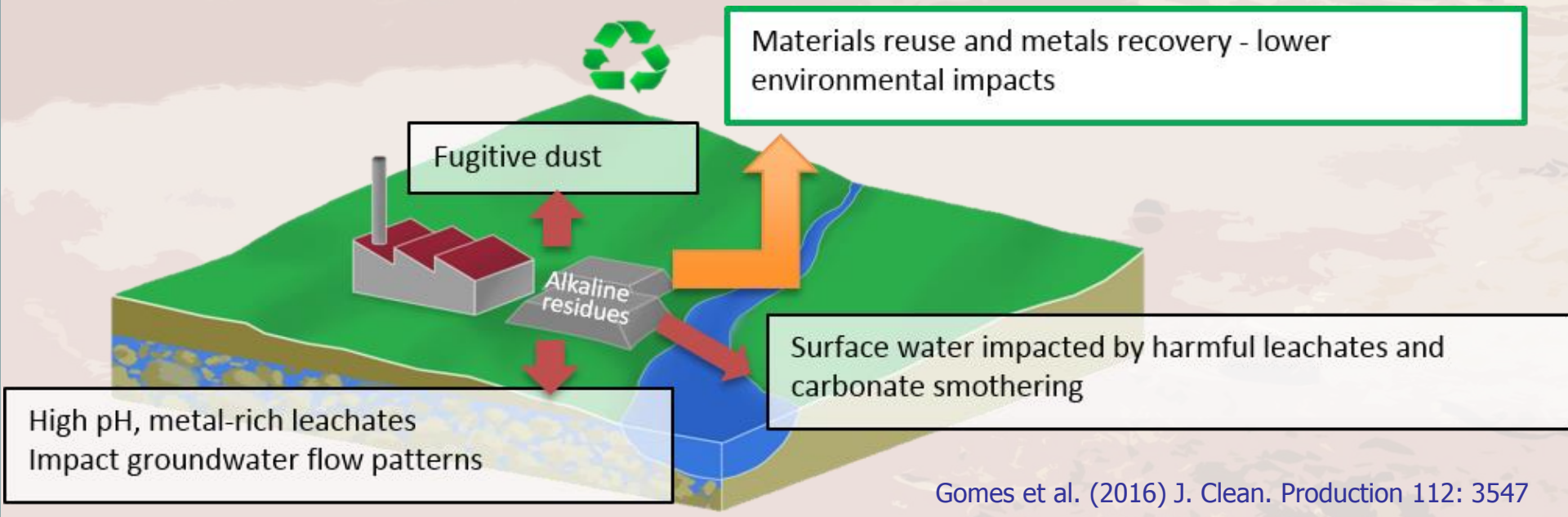
Aims

Improve basis for increasing value recovery from alkaline wastes (metals, carbon, bulk afteruse, land), while managing environmental impacts

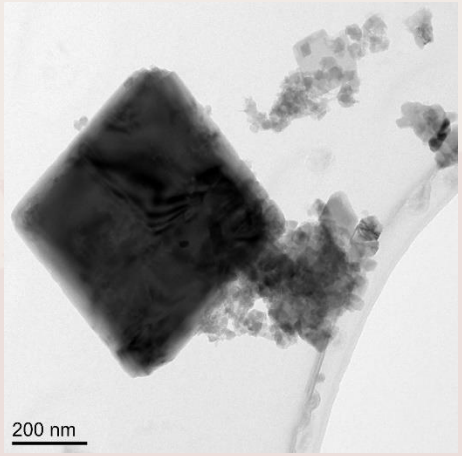
Consider challenges to resource recovery: policy, economic, social and technological issues

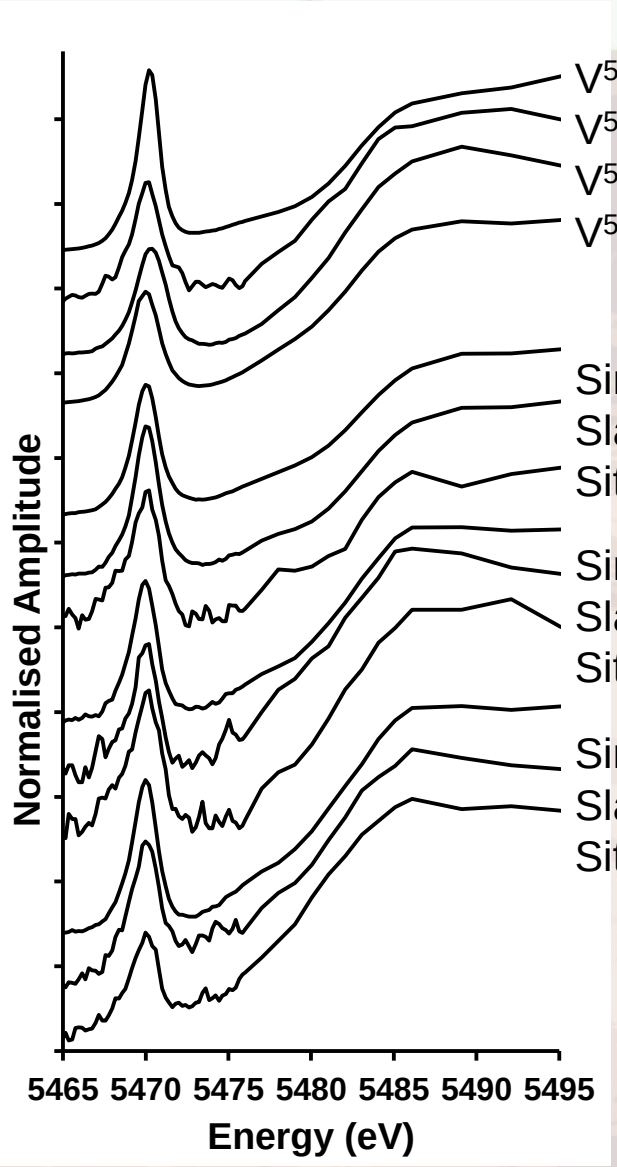


Gomes et al. (2016) J. Clean. Production 112: 3547

WP1: leaching mechanisms

- Improve understanding of leaching of V from slag
- Solubility controlled by Ca-vanadate at source
- V present in pentavalent (most toxic) form
- In environment Fe-oxides important in controlling d/s mobility

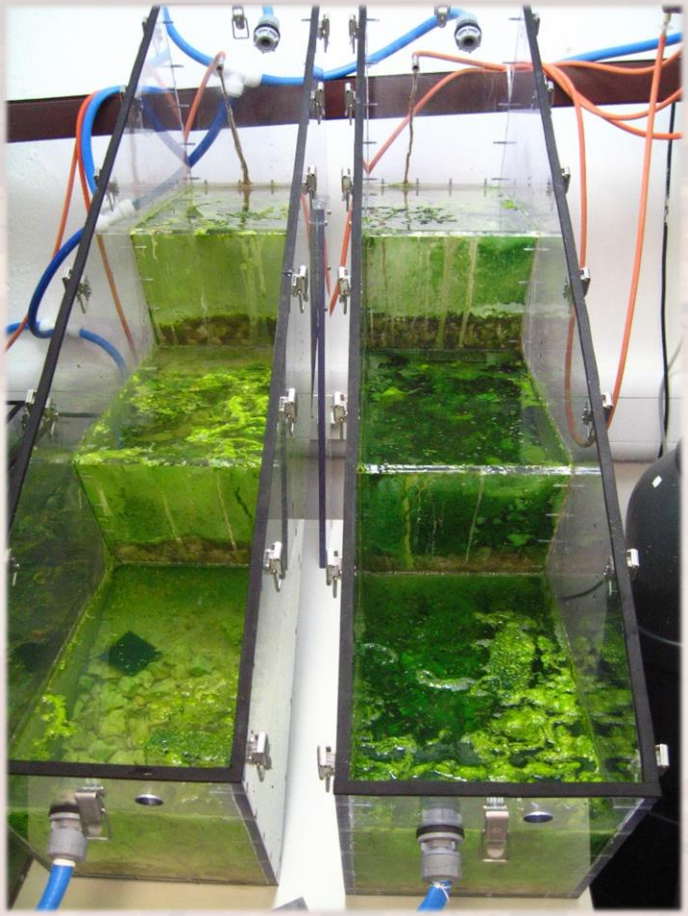




Hobson et al. (2017) in prep

WP2: metal recovery and leachate management

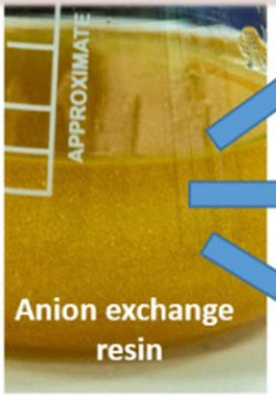
- V recovery from both steel slag and bauxite residue leachate successfully demonstrated in batch and column tests
- Highly selective removal
- Buffering mechanisms in flumes
- Feed into WP3



Steel slag leachate

pH 11.5

Vanadium conc.
0.1; 1 and 10 mg L^{-1}



Batch tests
> 99% removal

Column tests
< 14% breakthrough

Reuse of the resin
20 × reuse without lost of efficacy

Gomes et al. (2016) Environ. Sci. Pollut. Res. 23: 23034
Gomes et al. (2016) J. Environ. Mgt. in press

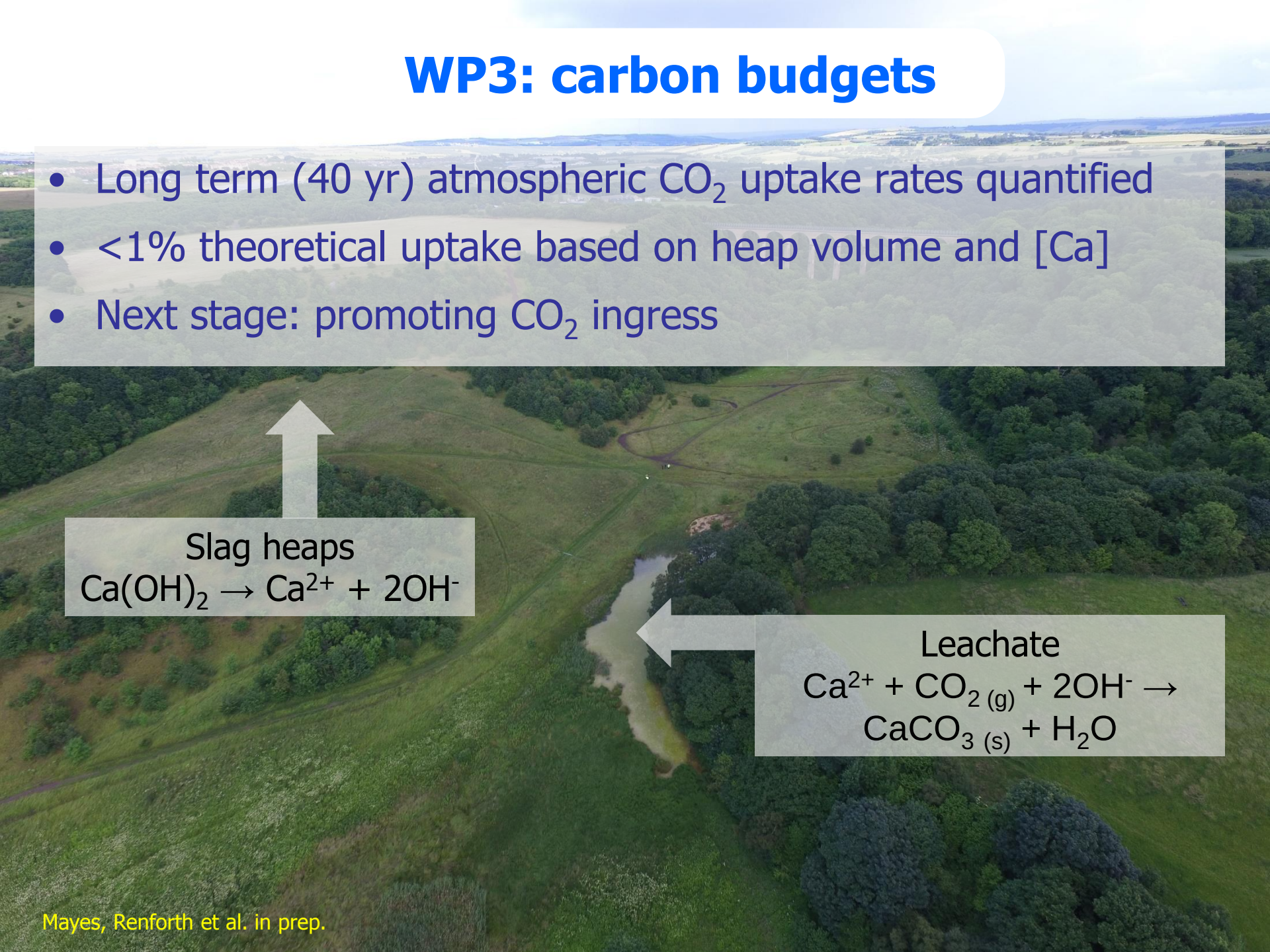
WP3: field pilot

- Pilot facility at British Steel, Scunthorpe
- High resolution monitoring of constructed wetlands
- Metal recovery unit for field deployment

BRITISH STEEL

WP3: carbon budgets

- Long term (40 yr) atmospheric CO_2 uptake rates quantified
- <1% theoretical uptake based on heap volume and [Ca]
- Next stage: promoting CO_2 ingress



Mayes, Renforth et al. in prep.

WP4: policy, governance, systems

- >20 interviews with range of stakeholders in UK and EU
  - Governance and policy issues around slag classification, regulation and markets
- Workshop in Redcar at Materials Processing Institute: *Options for resource recovery and environmental improvement at former Redcar Steelworks site*
  - Over 25 delegates
  - Industry, regulatory, regional development representatives

Deutz et al. (2016) *Geoforum*. Revision in review

WP5: Red mud and fly ash development

- Sustainable afteruse at BRDA: with Rusal Alumina
  - Long term metal(loid) cycling to inform risk assessments
  - Cost estimates for different treatments
- Bioleaching of metals from MSW ashes using acidophile bacteria

Bray et al. in prep.

Future funding

- Linked work with CIWM, Accademia Nazionale dei Lincei Italian Royal Society, STFC
- CASE studentship with Rio Tinto Alcan (University of Leeds)
- Proposal on carbon uptake in iron and steel industry (NERC GHG removal theme)
- Mobile lab – procurement in process, field testing 2017

Rio Tinto Alcan

CIWM

Science & Technology Facilities Council

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