

A red mud remedy

Following years of diligent research, scientists at Alcoa Western Australia have developed an effective way to deal with 'red mud', an undesirable bauxite residue generated in large quantities by alumina refineries.

For every tonne of alumina produced in Alcoa's Western Australian refineries, two tonnes of residue result. Half of this is a fine-grained material known as red mud and half is a coarser, sand-sized material.

The red mud contains residual caustic material, despite being washed in the refinery, and it therefore needs to be securely stockpiled (dry-stacked) in lined storage areas designed to protect surface and ground waters. Its high alkalinity has been one of the main obstacles to recycling it into other products.

The new process, called residue carbonation, is a high-speed industrial adaptation of a natural chemical process that not only reduces the alkalinity of the waste mud (from a pH of about 13.5 to 10.5), but also locks up carbon dioxide that would otherwise contribute to global warming.

'We see this as a double coup,' says Program Manager at Alcoa, Mr David Cooling. 'Stockpiling refinery residue has ongoing environmental and land-use implications and incurs significant storage costs, but carbonation makes the waste product more friendly to the environment and potentially re-usable, as well as offering the bonus of reducing industry greenhouse gas emissions.'

Alcoa's Technology Development Group, based at Kwinana, WA, has led the research and development work on residue carbonation in collaboration with Hatch Engineering, CSIRO Minerals and several universities. Dr Peter

Smith and his CSIRO colleagues at the CRC for Hydrometallurgy conducted the early research on the mechanisms behind the reduction of red mud alkalinity using CO₂ gas.

alumina refineries in WA. When red mud is pumped through the facility, it's aerated with carbon dioxide – which will be piped as a waste product from a nearby ammonia plant – and the associated chemical reactions reduce the alkalinity of the residue to levels found naturally in some soils. Alcoa

residue, including using it in brick and tile making, in fertiliser, as a filler in plastics or concrete, and as a replacement for construction sand. Carbonation of the red mud will simplify storage and handling of the material with these types of uses, making re-use more attractive.

The waste might even find a role as a soil amendment to help retain nutrients and to improve soil pH. Alcoa, in collaboration with Agriculture

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WA, is monitoring a number of soil amendment trials aiming to improve the sustainability of agriculture and this application is also now under investigation in Brazil and the United States.

'At Kwinana, the prototype residue carbonation facility is currently being upgraded to treat 100 per cent of the refinery's residue mud,' says Cooling. 'Apart from the other environmental benefits, this will lock up an amount of CO₂ equivalent to shifting 12 000 cars off the road ... and we are now planning to implement the technology at our other refineries as well.'

Indeed, Alcoa is confident that its patented and award-winning technology will soon become the new best-practice benchmark for treating refinery slurry at alumina refineries right around the world. That's a lot of mud ... and a lot of cars off the road.

● Steve Davidson



Left to right: Tom Donnelly (senior operator), David Cooling (residue development program manager), and research scientists Dr Amanda Tilbury and Dr Laurence Guilfoyle, on top of the Kwinana residue mud superthickener. Peter Garside/Alcoa



The Kwinana refinery's mud residue carbonation facility. Alcoa

Alcoa's small-scale field trials led to construction of a full-scale prototype carbonation facility at its Kwinana refinery, one of the company's three

has established re-use of residue across its worldwide operations as one of its strategic goals, and has investigated a number of potential uses for the red mud

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