Bauxite Residue Storage using Seawater Neutralisation

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AUSTRALIAN ALUMINIUM COUNCIL LTD

Seawater has been used to neutralise bauxite residue at the Queensland Alumina Limited (QAL) refinery for more than 30 years. It has also been used at the Rio Tinto Yarwun refinery, since its commissioning in 2004. While the initial use of seawater was driven by a drought, the benefits of effective neutralisation of any residual alkalinity in the slurry through reaction of the alkalinity with the magnesium and calcium in the seawater were soon apparent.

The operating practice at these refineries includes:

- From the last washer underflow, mud is pumped from the refinery to the residue disposal area (RDA) using seawater as a transport medium;
- At QAL the mud is mixed with additional seawater from the tidal estuary and held in an agitated tank reactor to chemically neutralise the caustic content;
- The magnesium and calcium in the seawater react with the caustic constituents to form a suite of chemically insoluble precipitates;
- Red mud and the neutralisation precipitates are separated in a conventional clarifier;
- The red mud is stacked in bays;
- The mud is farmed using amphirollers and dozers to consolidate the mud density;
- Clarifier overflow liquor is gravity fed into a decant pond for final solids polishing before being continuously discharged to the receiving environment; and
- Ongoing environmental monitoring of the discharge and receiving environment is undertaken.

Seawater neutralisation can provide an alternative treatment option to filter press technology, particularly in areas where there are limitations on freshwater availability. It is suitable for long-term storage, with less potential for environmental harm than classical storage of caustic residue. Depending on the local hydrology, it may be most effective when combined with lined ponds. Seawater neutralisation can deliver:

- pH of discharge channel around 7.8;
- Clear supernatant with suspended solids below 30mg/l;
- Dissolved aluminium around 0.5 mg/L (as long as magnesium is above 200 mg/L);
- Dissolved oxygen above 5 mg/L (but fluctuates);
- Solids after mud farming above 75%; and
- Reduced dust issues.

The chemistry of seawater neutralisation is complex; however, Australia's refineries have extensive experience in how to treat bauxite residue. This Australian expertise could be usefully applied at the increasing number of coastally located global refineries; which are relying on imported bauxite. The quality and composition of discharge after seawater neutralisation can also simplify the management of RDAs after closure.