

ATF-06-03—Management of Bauxite Residue (Red Mud)

Project

Worldwide, alumina (Al_2O_3) is produced from bauxite using the Bayer process. After digestion, bauxite residue (also known as red mud), is separated, washed and disposed of. Bauxite residue is highly alkaline in nature and contains oxides and salts of six major oxides of Fe, Al, Ti, Si, Na, Ca, and a variety of minor trace elements. Typically it contains in the region of 15 to 20 different mineral phases.

Around 1.5–2.5 tonnes of red mud is generated per tonne of alumina produced, depending on the bauxite source and alumina extraction efficiencies. The main environmental risks associated with bauxite residue are related to high pH and alkalinity, and minor and trace amounts of heavy metals and radionuclides.

A wide variety of potential uses has been suggested for the residue, and significant research has been done in a number of areas. Despite this, to date there are no economically viable and environmentally acceptable solutions for effective utilization of the high-residue volumes that have developed. Consequently, most of the bauxite residue produced is stored on land for future rehabilitation or use. Current best practice is to contain the material within specially constructed landfill sites, called red mud ponds/stacks or bauxite residue disposal areas (BRDAs). The intention is that, after exhausting the storage capacities, the landfill sites are either used for industrial or civil purposes or re-afforested to ensure merging with the surrounding eco-system.

The key focus areas of this project are to develop technically and economically sound options for:

- The productive utilization of bauxite residue in various end-uses including those application specific to the steel and cement industries (including the extraction of oxides and trace metals).
- Better stabilizing the residue (mechanical stability and chemical inertness).
- Utilizing minimum land for storage and ensuring faster rehabilitation of landfill sites.

Objectives

To develop technology and practices for the alternative use of bauxite residues that will reduce the reliance of stockpiling and storage.

Maximize the potential of bauxite residue for the steel and cement industries through the extraction of oxides and trace metals as viable substitutes to existing industrial inputs to production processes.

Performance indicators

By 2010, 50% of facilities will utilize 70% of red mud produced, in various end-uses that include industrial, construction and agricultural applications.

By 2010, 60% of facilities will reduce on-land storage of red mud by 40% through vertical stacking, post neutralization, mid-sea dumping etc.

By 2015, no facilities will be dumping bauxite residue into the sea.

By 2010, 30% of facilities will ensure that on-land storage areas containing leftover red mud will be closed and rehabilitated in the shortest possible time or the residue directed to beneficial use.

Milestones

2006–07 Undertake a detailed literature review of currently available technology and research.

Agree to a research priority list of those areas identified within the literature study that have the most promising outcomes.

Engage with the steel and cement industries to address any cross-sectoral applications and potential project partners for future trials.

2007–09 Undertake R&D activities on promising technologies and applications.

Pilot test the most promising options.

Identify financial mechanisms to implement strategies to enhance bauxite residue utilization.

2009–10 Implement on commercial scale at trial sites and exchange technology among member companies.

Develop an ongoing implementation plan and future benchmarks for future uptake of the technology and practices.

Resources

Information sharing on the existing methods related to the utilization of red mud among participating countries.

R&D to support basic research on priority areas identified. Resource to be provided by participating Partner countries

Consultancy to develop data collection pro formas and to collect, collate and analyze the information relating to characterization of bauxite residues and processability studies for meeting various end-uses. Resources to be provided by participating Partner countries.

Consultancy to further develop technology for faster rehabilitation of closed bauxite residue sites. Resources to be provided by participating Partner countries.

Facilities and infrastructure for conducting trials with treated bauxite residue in identified end uses. Resources to be provided by participating Partner countries. Government may allocate funds and extend research facilities for the same.

Review by experts on the environmental and safe use of the options developed for bauxite residue use, especially environmentally sensitive areas.

Presentations, workshops and site meetings hosted by participating companies and supported by industry experts (e.g. consultants, researchers) to disseminate aggregate data results and analysis of measures.

Project identification, development, financing and implementation by companies supported by internal and external resources (project and financing consultants, in-house staff).

Participation

Australia, China and India.