The journey
When Rio Tinto Alcan’s (RTA’s) alumina refineries and mining operations in Jamaica were sold to the Glencore group in 2001, a number of bauxite residue landfill sites associated with the plants were retained with the understanding that RTA would safely remediate them and ultimately transfer ownership to the Government of Jamaica.

RTA was the first aluminium company to establish refineries in Jamaica and they successfully operated there for some 50 years. The assets sold included two refineries, related bauxite reserves and active mine sites. The waste sites they retained were based around the two refineries Ewarton and Kirkvine: 13 impoundments near the Kirkvine refinery, a large bauxite residue deposit at Mt Rosser and several other landfills close to the Ewarton refinery.

Of the 13 ponds (totalling 45 ha approximately) to be transferred to government ownership at Kirkvine, six were classified as ‘exposed’ ponds where no restoration had been attempted, one had been partially restored; and six had been classified as ‘closed’ ponds and had been previously substantially restored or naturally revegetated. In addition, an asbestos repository and a concrete tomb for storing oxalate required long term remedial solutions.

The rehabilitation of old red mud impoundments has been helping to set the standards on closure of bauxite mining and refinery facilities in Jamaica. The sites are fast developing a reputation as being leading best practice models; achieving our aims with maximum biodiversity through effective collaboration.

New vegetation at the remediated Kirkvine site.
The Mt Rosser pond, which extends over 37 ha, was constructed in 1959 to act as a tailings pond to take the red mud (bauxite residue) from the Ewarton plant. The red mud was pumped to the pond over a period of about 32 years up until 1991 in the form of slurry comprising about 20% solids. When the pond was replaced in 1989 by the Charlemont Dry Stacking Facility, Mount Rosser was only used as a back-up storage facility and eventually no bauxite residue was sent to the site.

Following preliminary studies and discussions with the government and regulators, the remediation project was launched in July 2004.

**The transformation**

Many of the former bauxite residue sites are unrecognizable today, supporting a wide variety of plants and wildlife. The vegetation at all the Kirkvine ponds now meets the agreed closure standards and the process of handover has begun. At Mt Rosser, rehabilitation continues, with the bulk of the remaining work being the regrading of the profile and revegetation of the site. The project is expected to be complete by 2017.

Whilst vegetation grows well in the Jamaican climate, it does not like the elevated pH and physical conditions of old red mud ponds. The standard method would be to cap the land using much sought after topsoils and revegetate. The closure plan challenged this response to dealing with bauxite waste and aimed to establish best practice (i.e. best cost-to-risk safe solution) not only for RTA but also as a legacy for the alumina industry in Jamaica as a whole.

Capping soils are very scarce in Jamaica, so the plan was to vegetate the sites using a “Topsoil Free” method (or, if looking at it from the future, a soil creation process). Trials at Kirkvine’s Pond 6 have shown this process can be very successful. By using a combination of chemical and physical treatments, nature itself and time, the residue surface can develop into a soil capable of sustaining vegetation thus avoiding unnecessary remedial works. The knowledge acquired from the “Topsoil Free” trials was subsequently applied to all of the other exposed ponds.

The decision to revegetate rather than redevelop the sites was made following a wide-ranging review of all short and long term risks. The ground is not sufficiently stable for buildings, and whilst the chemical uptake of plants was minimal the long term use for agricultural or other resources was not considered a sustainable and viable proposition. The Regulators agreed and were keen to have improved biodiversity in this area so this solution suited both parties.

The research and the subsequent remedial works proved very successful and over the space of just a few years, red mud wastelands became green thickets.

Many of the former bauxite residue sites are unrecognizable today, supporting a wide variety of plants and wildlife.

At Mount Rosser, the remediation involves the intercepting, monitoring, treatment and discharge of the ponded water to enable the muds to be reshaped and allow free drainage towards the rock wall of the dam to the south. The bulk of the remaining work includes this re-profiling by way of a newly designed high solids mud pumping technique, the stabilization and conditioning of the relatively high pH muds and, finally, soil free revegetation. Once the run-off water is clean the dam wall will be lowered further to improve stability.
Legacy Management case study
information.legacy@riotinto.com

June 2013
riotinto.com

Exposed pond, Kirkvine.

Highlights
The closure process resulted in the development of a remediation programme for the red mud disposal sites that met high ecological and sustainability standards as well as minimising risk. Some aspects of these remediation works particularly at Mt Rosser had never before been attempted and it was accepted by all parties that on-going discussion would be required as challenges surfaced. When these occurred, they were addressed; solutions were considered and progress was made without compromise to the over riding safety of the community and the environment.

The technical challenges of the closure process are often the focus of the Jamaica remediation story and yet it is vitally important to recognize the significant part played by the open engagement and relationships forged with a variety of stakeholders. This includes:

- Early involvement of local communities and regulators to understand their expectations and concerns
- Maximizing employment and implementing training/capacity building within the local community
- Ongoing and regular engagement with the regulators and communities to resolve any emerging challenges
- Ensuring compliance with nationally and internationally recognized bodies of expertise to guarantee technical excellence, and
- Creation of a legacy of best practice.

The level of productive collaboration between regulators, communities and RTA, is central to the project’s success. The engagement process has had its fair share of challenges along the way but the trust built up over time ensures that a safe resolution of issues is always the prime aim and that, in addition, all parties are able to learn from the experience.

The Jamaican government created the Jamaica Bauxite Institute (JBI) in 1976 to oversee the local bauxite and alumina industry and they have played a pivotal role in its growth, providing support for research including that of sustainable development and closure planning. As the project manager for the various regulators, they have been an enthusiastic and valuable partner in the rehabilitation project, jointly developing innovative, safe solutions acceptable to all stakeholders.

Through using RTA’s Value Risk Management Process, the outcomes were compliant, cost effective, safe and sustainable. In due course, when the remediation work is complete, the ownership of the land will be passed onto the Government of Jamaica.

Vegetative and chemical uptake investigations have been conducted on all remediated ponds by the University of West Indies and have been widely reported by RTA and JBI. Both the works and testing have been conducted and communicated in a transparent manner and form part of the legacy of best practice for the project.

At the time of sale, RTA also promised to establish a Legacy Fund to acknowledge the many years of working with, and alongside, the people of Jamaica. Whilst it has been a challenge to ensure that the fund would address real community needs and be sustainable, it has now come to fruition and has helped to demonstrate to the community and government that despite the many setbacks, RTA continues to meet all of its promises.
The Jamaica Bauxite Institute has been an enthusiastic and valuable partner in the rehabilitation project, playing an important role in supporting innovative safe solutions acceptable to all stakeholders.

**Lessons learnt**

Essential lessons that have been learnt along the journey include the importance of:

- Early engagement with ALL stakeholders to understand their expectations and concerns and, critically, to listen with an open mind to others’ ideas.
- Implementing a value based risk management process based upon a multidisciplinary input and active tracking.
- Agreeing to target objectives and required standards as early as possible in the process even if these may need some modifications as time progresses.
- Holding regular discussions with all stakeholders to ensure that emerging issues are nipped in the bud.
- Adopting environmental criteria and a process that delivers internationally recognised standards whilst leaving room for innovation and flexibility.
- Establishing a partnership between the company and the regulators so that each understands the others’ needs and challenges.
- Avoiding imposition of a “one size fits all” solution as it can be shown that transparent engagement does provide the confidence to adopt more risk-based cost-effective alternatives.

• Giving regulators maximum notice to consider and approve risk-based solutions; therefore the earliest delineation of site conditions is vital.

That said, the lesson of most value is the importance of restoration during operation. Had such a policy been applied in Jamaica at the time then these sites they would have been remediated at a fraction of the final costs to RTA.

**Our Vision**

We aim to ensure that our legacy sites are made safe, that all problem areas are addressed cost-effectively, and that there is a sustainable socio-economic future for the community together with a minimised aftercare burden.