New borates from old ponds

Rio Tinto Minerals' Boron Operations is home to one of two world class borate deposits on the planet. The company has been mining there since 1928, guided by comprehensive mine plans designed to optimise costs and balance extraction of the deposits' two primary ores, kernite and tincal. Kernite is used to make boric acid, an essential ingredient in specialty glass used to make solar panels. Tincal is used to make borax pentahydrate, most of which ends up in insulation glass fibre used to make buildings more energy efficient.

The nature of the deposit creates challenges, particularly as it deepens. In fact, extracting the right balance of ores in a cost efficient manner becomes a monumental task and a mismatch between the mine plan and the marketing plan can arise.

At one stage, the mine plan would have produced 25 per cent less tincal than marketing plans called for. So a cross functional team representing the mine, refineries,

Borate rich liquids from the production process captured in ponds and left to evaporate are now being re-mined (below) for further processing.

pilot plant and environmental department was formed to find a solution.

They found it in one of the operations' old reclamation ponds – a repository for effluent from the borax pentahydrate process. Described simply, this process involves crushing, washing and drying the tincal ore. The team struck upon the idea of harvesting the borates that have accumulated in the old reclamation ponds and sending them back through the refining process to restore ore balance as cost effectively as possible.

"The way the ponds were created is essentially the same way the ore deposit was created – borate rich liquids were captured in an impermeable basin and left to evaporate over time. The only difference is that the deposit we made was created over the course of decades, while the deposit nature made was created over the course of millennia," says Dave Mitchell, manager, Mine Technical Services, and project leader. This deposition phenomenon was not recognised until reclamation work unearthed it – literally.

The team conducted pilot tests to ensure the pond ore would work within existing processing parameters. Tests proved successful and extraction is now in full swing. The reclamation pond is a significant resource, and the team estimates that it will yield 4.8 million tonnes of ore. Because very little overburden and no blasting is involved, pond mining costs are about half the amount incurred mining the deposit. Rio Tinto Minerals will save an estimated US$50 million over the course of the project.

Environmental permitting was required, and the team had an advantage in securing permits because they were able to prove that recycling the old pond would lower greenhouse gas emissions and energy intensity. The project will ultimately result in a net decrease of 90,000 truck hours and 3.8 million gallons of diesel fuel.

Another benefit of harvesting the old pond relates to a different type of recycling. Boron Operations builds a new pond every three years – and it costs about US$12 million to build a new one and up to US$4 million to close an old one. Due to the presence of endangered species such as the desert tortoise and the Mohave ground squirrel, Rio Tinto Minerals is also required to purchase three to five acres of equivalent desert habitat to offset every acre it disturbs. Using the old pond's footprint to locate new ponds means no new land is disturbed.

Harvesting the old reclamation pond resulted in a host of environmental, economic and social benefits – making it an excellent example of sustainable development in action. It will also provide a bridge to a longer term project designed to close the ore balance gap at Boron Operations – modified direct dissolving of kernite – which will allow the operation to remain flexible and efficient in meeting customers' needs for decades to come.