ENGINEERS AUSTRALIA
GENERAL EDITION
Vol 85 No 4, April 2013 $7.05 inc.GST

ea engineers australia

The nine shades of WHS due diligence

Christchurch's Cardboard Cathedral

NEWCASTLE

TERMINALS, CHEMICALS, BULK MATERIALS

Extracting iron from waste

There's a lot of large-scale infrastructure on Kooragang Island in Newcastle, and while Austpac's Newcastle Iron Recovery Plant is comparatively small it is still an intriguing engineering feat. The site's construction initially stalled due to a lack of available funds, but after capital raising, work recommenced in January. Since then, Austpac has overcome the challenges of a highly compact site to continue building a plant that recovers pure iron from products previously discarded as waste material.

The plant is based around a process called EARS, or Enhanced Acid Regeneration System (see the boxout *Lend me your EARS*). Originally developed by Austpac at the TUNRA Bulk Solids research centre at the University of Newcastle, EARS produces hydrochloric acid and iron pellets from the iron chloride leach liquor generated by manufacturing synthetic rutile (titanium dioxide), or synrutile. This is created from another of Austpac's proprietary processes, Enhanced Roasting and Magnetic Separation Synrutile (the ERMS SR process; more information at <http://bit.ly/YKbLY4>), which processes ilmenite (titanium ore) into synrutile.

Austpac managing director Michael Turbott told *Engineers Australia* that when testing the EARS process in 2008 with "spent pickle liquor" (an iron chloride solution generated from hydrochloric acid when preparing steel for coating) an idea was raised. Austpac general manager of process technology and engineering John Winter suggested blending mill scale and electric arc furnace dust with the liquor to improve the yield of iron. These consist of iron oxide that is normally considered as waste, with the challenge for companies like steel mills being how to appropriately dispose of it rather than how to reuse it.

Pilot work was conducted that showed that when 2t of iron oxide waste was added to 1t of liquor, it was possible to extract 1t of hydrochloric acid and 1.6t of iron. There was significant interest from industry in this process, which lead to the development of the Newcastle Iron Recovery Plant.

Originally a hydrofluoric acid plant built in 1971 and closed down in 1988, Austpac had to remove what remained of the derelict chemical processing equipment so the company's proprietary new acid regeneration and iron reduction equipment could be installed in the old process tower. The strong power, water and transport infrastructure surrounding the site is why Austpac chose it despite the limited available space. Two new buildings had to be added to the existing framework.

Austpac had to carefully design the site to fit in all the required equipment, including fluid beds and solids transfer infrastructure. Interfacing between the existing and new structures was a particular challenge for Austpac. Spill safeguards are also in place, although Winter told *Engineers Australia* it was not a challenge to find enough space for them.

On completion, the plant will be 20m high at points, and when *Engineers Australia* toured the site in March, the site's skeleton already loomed tall overhead.

Although the site used to have a low voltage electricity supply, following a discussion with Ausgrid it was decided that a high voltage supply was more appropriate for the estimated load for the new plant. Austpac engaged Power Control Engineers (PCE) to extend the existing 33kV privately owned network on the site to provide the required high voltage supply for the plant. PCE general manager Dennis Slade explained that this posed a number of challenges.

To avoid installing additional overhead electrical equipment (a hazard on this site where many trucks and cranes operate) and for ease of installation, PCE procured compact SF_6 insulated metal clad switchgear for the new transformer feeder.

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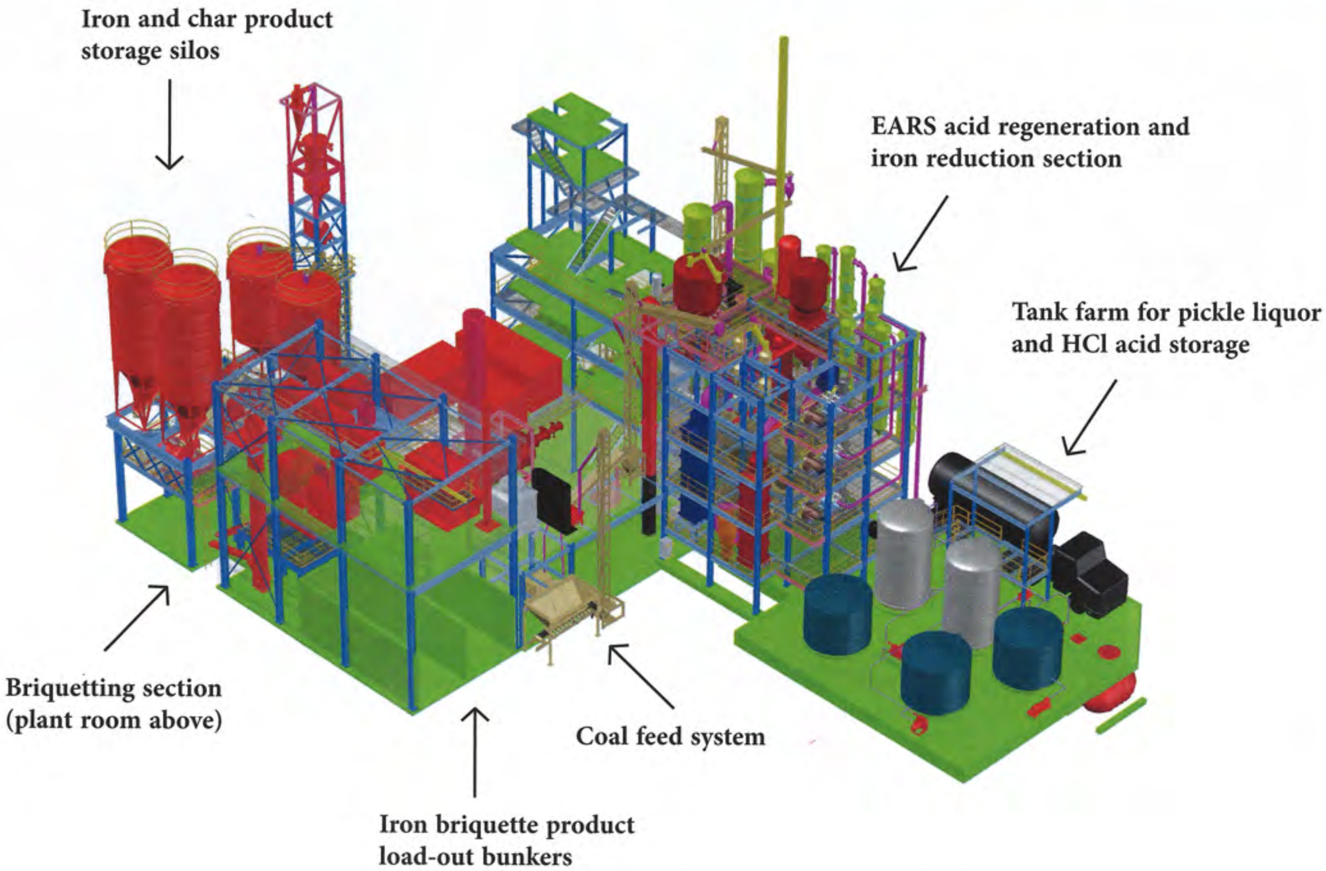
Finding space for a new power transformer and managing the fire risks associated with oil filled electrical equipment was not easy but a solution was found through some careful site design.

Cable trenching on Kooragang is difficult due to the high water table which would cause even a 1m deep trench to collapse. Further, because the island was historically used to dump mineral waste, there are random pieces of metal slag called "skulls". To avoid these, PCE proposed the use of trenchless technology to install a 140mm diameter high density polyethylene (HDPE) pipe 4m underground using controlled horizontal directional drilling to allow electric power to reach the plant.

Electrical earthing is also a challenge on Kooragang. The sand on the site has a high electrical resistance, which means that dissipating electric current into the ground in the event of

A 3D rendering of Austpac's Newcastle Iron Recovery Plant.



an electrical earth fault without producing a dangerous earth potential rise is difficult. Several deep earth electrodes and maximum use of civil structures and reinforcing together with the application of risk based earthing design techniques has allowed a design compliant with the latest earthing standards to be produced.

Feedstock for initial operations at the Newcastle Iron Recovery Plant will be provided by CMC Cometals (who will supply mill scale and purchase the iron products) and Orica (which will supply the spent pickle liquor and purchase the regenerated hydrochloric acid). When the plant reaches full operating capacity it will produce around 18,000t of iron (as pellets or briquettes) and 18,000t of acid (25% HCl) each year. Austpac expects to start commissioning the plant during the third quarter of 2013 and commence production in the fourth quarter. ■

Lend me your EARS

Austpac's Newcastle Iron Recovery Plant is designed around a process called Enhanced Acid Regeneration System, or EARS. Based on pyrohydrolysis (heated fluid beds), the process compares favourably to existing regeneration methods. It is more cost effective in terms of capital and operating costs, and it produces below detectable limits of dioxins and furans (both pollutants) which are created by regeneration processes. For more information about the process, go to <http://bit.ly/YFMHHS>.