Appendix C – Processing of the Kaolin Ore

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The processing plant for the ore will be covered under a separate EIS once a site has been finalised for the operation. While approval for the processing area is not being sought in connection with this EIS, the following conceptual information is provided in order to give as complete a picture as possible of the operations.

Location

The plant will be located at a site with:

- **rail access** – to enable the ore to be brought to site by rail from Newnes Junction;
- **sufficient land area** – in order to have adequate room for stockpiles, plant buildings, thickeners and load-out facilities etc., an area of approximately 8 ha would be required;
- **considerable quantities of water** – while the plant will recirculate large quantities of water, there will be no net liquid effluent from the plant and an overall make-up of around 730 L/min of good quality, fresh water is required;
- **power** -the plant will require in the order of 2.5 MW of power. This power may be available from the NSW energy grid or from a privately owned, remote operation, co-generation gas plant; and
- **proximity to transportation routes** – the various products produced at the processing plant would be transported to market by a variety of trucks with an average capacity of around 25 t. Virtually all the markets for the products would be through Sydney. To achieve the required economic throughput in a socially responsible nominated working window, a throughput of 450 t per hour is necessary. To shift 450 t of products by 25 t truck would involve 18 trucks per hour, ie. one truck or two truck movements every 3.3 minutes.

Given the above criteria, it is considered environmentally more responsible and financially more economical to locate the processing plant in an industrial area on the outskirts of Sydney. While the exact position of the site is not known, the parameters required for the site will determine where the processing plant will be located.

Processing Plant

A processing plant for extraction of kaolin from the sandstone ore, has been designed to conceptual stage by Roger Smith & Associates Pty Ltd.

The processing plant will be required to handle two types of ore and the plant will be designed to handle initially up to half a million tonnes per annum. The plant design enables duplication of the processing lines to ultimately reach the 1.4 million tonnes per annum goal.

Some items of equipment such as pumps, cyclones etc, have little or no resident volume and can be readily swapped from off-premium to standard ore feed with little or no cross contamination. Other equipment (pug mills, attrition cells, thickeners etc.) contain large volumes of resident slurry and the costs and lost time involved with cleaning out these devices between different ore types would be prohibitive. In practice, the changeover from one ore type to the other will be automatic and remotely controlled from a control cabin by the operator. The plant will also be designed to produce a high density clay slip, a dry bagged kaolin, or a combination of both, as dictated by the market.

It is intended that the initial plant will produce a high density kaolin clay slip, a white silica sand and fine silica. When the plant is up and running, it will be extended to produce higher grades of kaolin and higher grade silica products. The fine silica produced will also be further treated to produce silica flour.

Train Unloader and Stockpile

Train unloading will occur by bottom dumping over a small bin. A simple belt feeding system will control feed onto a tripper conveyor which will elevate and stockpile material in an identical manner to that at Newnes Junction.

Pug Mills

Initial size reduction will have been completed at the mine by the crusher. At the processing site, a rolling/abrading action will be used to break up the remaining aggregates and liberate the kaolin. A high density, wet Pug Mill will be used to do this. At any one time the Pug Mill will contain several tonnes of material and it is impractical to clean it out when changing ore types. It will therefore be necessary to duplicate the mill and a simple diverter gate on the feed chute will switch feed from one circuit to the other.

Primary Screen

Coarser pebbles and grits will be screened out to produce a minus 2 mm feed to the remainder of the circuit. The Mogensen Semi-Probability type screen has been chosen. This screen has 5 cascade screens and off these two oversize fractions will be produced as required. It will also be necessary to add washwater to the screen.

Coarse Pebbles, Sandstone, Ironstone etc

Coarse material removed from the ore will be sold either as decorative gravel or as filter gravel, driveway gravel etc.

Decorative gravel is composed of white quartz pebbles which have a high value when clean. The gravels will be taken from the coarse screens and conveyed to a conventional, elevated, truck loading bin which will discharge to a stockpile if filled beyond capacity. Harder lumps of sandstone, ironstone and some pebbles will be separated out for sale as lower quality gravels.

Cyclone Desliming Circuit

Because of the high clay content of the sandstone, it is necessary to dilute the feed to achieve a satisfactory separation of the minus 75 μm clay/silt fraction from the minus 2 mm plus 75 μm sand fraction. The pulp will be relatively viscous and a high energy gravity separation device will be required. Cyclone desliming, using different sized cyclones will be used. The circuit will consist of three stages of desliming and to conserve water, dilution water for the second stage will be provided from the overflow of the final dewatering stage.

Silica Sand

The final dewatering cyclone will discharge clean sand onto a conventional drainage pad. The cyclone will be mounted on a tower and swivel arm to allow stacking onto a donut shaped drainage heap. This is a cheap and simple temporary system that allows drained sand to be loaded out from one point while wet sand is being discharged further around the heap. In the initial stages, until the process development testwork has been done, the sand would be sold as a concrete sand. As soon as practicable, the sand would be further processed to produce high quality silica sand for the glass industry and for other industries requiring a premium white silica product.

Fine Sand Circuit

Fine silica needs to be extracted from a very dilute clay slurry. The volume of slurry will be reduced by counter current washing in the final desliming stages and a hydrosizer will be used to provide initial desliming. This will remove the bulk of the water and fine clay and reduce the volume to a manageable level. Small, high pressure cyclones will be used to make the 10 μm split. The number of stages will ultimately depend on market requirements.

It is impractical to empty and clean out the hydrosizers, so a duplicate circuit will be installed to handle the off-white kaolin and associated fine silica.

Kaolin Circuit

It is anticipated that the kaolin type clay in the Newnes deposit will settle to a density of about 25-30% solids w/w under gravity in a thickener. Clays may flocculate and settle naturally and it may be feasible to run the thickener without the use of flocculants. The settling rate may be improved by the use of flocculants but the final density is unlikely to be any higher.

The thickener underflow will be dewatered to achieve the pulp density required to market the new product. A decanter type centrifuge is expected to generate densities as high as 65% solids. By the addition of suitable reagents it should be possible to make a 60% solids slurry that is about the consistency of cream. This is a common practice and kaolin slurry of this specification is standard feed for many industries. Storage for shipment is in tanks fitted with low energy, rake type agitators. The slurry is readily pumped and transported by conventional road tankers.

This circuit will be duplicated to handle off-white kaolin.

Dry Bagged Kaolin Circuit

Some markets require a high value dry bagged kaolin product, and equipment will be provided to allow this product to be made.

To produce this product, a filter press will be used to filter the kaolin. For the plant a horizontal automatic pressure filter will be used and a moving strand, tunnel drier will dry the filter cake. Dried filter cake will be milled using a multiple hammer, swing hammer mill. Product sizing will be controlled by air sizing with oversize being returned to the hammer mill feed.

A conventional bagging system incorporating a weightometer will allow the bagging of product into 25 or 50 kg paper bags or 1 tonne bulker bags.