Crushtide Ltd (‘Crushtide’) is a producer and exporter of phosphoric acid, which is a commodity used locally and internationally to make catalysts, rustproofing materials, chemical reagents, latex, dental cements, tooth whiteners, toothpaste, disinfectants, food supplements, carbonated beverages, polishes and animal feeds.

Crushtide is a highly successful company which maintained profitability even during the global financial crisis. The company has been in operation for 30 years and operates an opencast mine in Phalaborwa and a processing plant in Richards Bay. The chief operations officer of the company, Mr Alan de Villiers, attributes the success of the company to the risk management strategy which requires the hedging of –

- the phosphoric acid selling prices which are dependent on economic outlook;
- currency risk, as the phosphoric acid prices are quoted in US dollar (USD); and
- currency risk, as the company imports sulphuric acid quoted in Canadian dollar (CAD).

### Mining of phosphate rock

The production of phosphoric acid by Crushtide begins with the mining of phosphate rock from the company’s opencast mine in Phalaborwa, Limpopo Province. The mine produces between 1 200 000 and 1 500 000 tonnes of phosphate rock concentrate annually, depending on expected market demand. Budgeted production of phosphate rock concentrate for the financial year ending 31 December 2014 is 1 400 000 tonnes.

Production of the phosphate rock concentrate at the mine entails the following key steps:

- Drilling and blasting;
- Crushing and milling of the ore;
- Adding of reagents (substances used to cause a chemical reaction) to the crushed ore slurry; and
- Filtration and drying to drain water from the phosphate rock concentrate.

The mining operations are heavily reliant on labour and machinery. Crushtide budgeted R52 380 000 for its miners for the 2014 financial year (‘FY2014’) based on paying its labour force of 485 miners at an average hourly rate of R60 per miner. The mining machinery and labour are used in the drilling, blasting, crushing, filtration and drying processes. The mining machinery was replaced five years ago at a cost of R686 million. The machinery that was in use at the time was fully depreciated and broke down often. When the replacement machinery was purchased it was estimated to have a useful life of 20 years and Crushtide elected to depreciate it on the straight-line method.

A pre-determined production overhead recovery rate of R32,50 per direct labour hour is budgeted for mining production overheads (indirect labour, water, electricity, repairs, etc.).

Reagents added to the ore slurry are sourced from local suppliers on a just-in-time basis. Crushtide does not carry any opening or closing inventory of the reagents. The budgeted cost of reagents for FY2014 was based on the estimated production cost and market prices and has been calculated at R4 500 000. Apart from labour, depreciation of mining equipment, production overheads and the cost of reagents, there are no other expenses associated with the production of the phosphate rock concentrate.
Processing of phosphate rock concentrate

Once crushed, milled, filtrated and dried, the phosphate rock concentrate is railed to the processing plant in Richards Bay in the province of KwaZulu-Natal, 820 km away. Crushtide is budgeting to incur a cost of R16 per tonne in FY2014 for transporting the phosphate rock concentrate via freight rail to Richards Bay. Crushtide elected to locate its processing plant in Richards Bay due to the port infrastructure which is necessary for the export of finished products to global markets and for importing sulphuric acid (used in the processing of phosphate rock concentrate).

The processing of phosphate rock concentrate at the Richards Bay plant generally results in the production of one tonne of phosphoric acid (finished product) for every four tonnes of phosphate rock concentrate processed. Crushtide is budgeting to produce 350 000 tonnes of phosphoric acid in FY2014, which represents normal capacity. Crushtide currently exports 60% of its phosphoric acid to Europe and sells 40% locally. Selling prices are identical for exports and local sales and Crushtide is budgeting to sell phosphoric acid at USD78.40 per tonne in FY2014.

In order to produce phosphoric acid, a reaction is initiated between phosphate rock concentrate and sulphuric acid to form weak phosphoric acid in slurry form. The reaction process requires one tonne of sulphuric acid for every ten tonne mix of phosphate rock concentrate processed. Crushtide imports sulphuric acid from Canada at the fixed price (hedged) of CAD8,00 per tonne.

The resultant slurry is then filtered to remove gypsum particles as a waste product in order to convert the weak phosphoric acid into the finished product (high grade phosphoric acid). Crushtide deems the ‘split-off point’ to be at the end of this filtration process. Crushtide is budgeting to produce 50 000 tonnes of gypsum particles in FY2014, based on the budgeted production of phosphoric acid. Gypsum particles are disposed of in an environmentally friendly manner into the ocean. The process of producing phosphoric acid and discharging the gypsum particles is highly automated and relies on the use of the sophisticated and intensive plant built at the Richards Bay plant.

The following data have been extracted from the records of Crushtide with respect to the production costs incurred by the company on the Richards Bay plant for the current year with regard to the production of the phosphoric acid:

<table>
<thead>
<tr>
<th>Financial year</th>
<th>Production costs (R)</th>
<th>Total number of employees</th>
<th>Total plant operating hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>22 656 000</td>
<td>43</td>
<td>1 180 000</td>
</tr>
</tbody>
</table>

Plant operating hours noted above represent the number of hours the Richards Bay plant is in operation for processing phosphate rock concentrate into the phosphoric acid. Operating hours at the Richards Bay plant are expected to reach 1 350 000 hours, operated by 45 employees, in FY2014. These operating hours have been calculated based on the number of machines operated at the plant during the operating hours in a year. The average production costs per plant operating hour are expected to increase by 7% in FY2014 from the prior year.

Crushtide does not have opening or closing inventories of phosphate rock concentrate, phosphoric acid, sulphuric acid and gypsum particles.

Crushtide spent R12 621 780 on plant and machinery at the beginning of FY2012 to discharge gypsum particles into the ocean in a manner that is not harmful to aquatic and
marine life. This plant and machinery have a ten-year useful life and are depreciated on a straight-line basis. In addition to the infrastructure used to dispose of the gypsum particles into the ocean, an average cost of R4,20 per tonne of gypsum particles is incurred during the disposal. After the filtration process to remove gypsum particles, concentrated, high-grade phosphoric acid is produced by boiling off excess water. This process has an estimated cost of R1 824 922 for FY2014.

### New revenue streams

Crushtide researched various opportunities to generate new revenue streams that could easily be incorporated into the company’s existing business model. The opportunity to sell gypsum particles rather than dispose of these as a waste product was identified as the most lucrative new business opportunity. Gypsum particles are used as a major raw material in the production of gypsum boards, which are used for the construction of internal walls and ceilings.

On 31 December 2013, Crushtide acquired 100% of the equity of Gypsum Mauritius (Pty) Ltd (‘Gypsum Mauritius’), a company based in Mauritius that manufactures gypsum boards. Gypsum Mauritius is incorporated in Mauritius, has been in operation for the past eight years and has retail outlets throughout Mauritius for the distribution of the gypsum boards. The strategic rationale for the acquisition was for Crushtide to acquire the skills to manufacture gypsum boards, with the intention of eventually opening a similar manufacturing facility in South Africa. Crushtide will transport the gypsum particles produced at its Richards Bay plant to Gypsum Mauritius at an estimated transportation cost of R15 per tonne.

The investment in Gypsum Mauritius is strategic, as any dividends declared by the company to Crushtide will not be subject to a dividend tax because Mauritius has a tax-free dividend policy. The corporate tax rate in Mauritius is also lower than in South Africa, with companies domiciled there being taxed at a rate of 15% of taxable income. Crushtide and Gypsum Mauritius have commenced with negotiations on the purchase price that Gypsum Mauritius will pay for gypsum particles purchased from Crushtide. Gypsum Mauritius uses 75 000 tonnes of gypsum particles annually. The two companies are considering the following two options:

- Cost-based transfer price; or
- Market-based transfer price (using either the fair value or cost plus mark up).

Gypsum Mauritius currently sources gypsum particles from suppliers based in Mauritius, India and the United States. Gypsum Mauritius paid an average of R72,00 per tonne for gypsum particles during FY2013. Crushtide is reluctant to base the gypsum particle price on ruling market prices and would instead like to apply its average mark up of 55% to the estimated cost of producing gypsum particles. However, the management of Crushtide is struggling to allocate production costs to the gypsum particles as it has not done so before.

### Estimated average exchange rates for FY2014

The estimated average exchange rates for FY2014 for South African rand (ZAR) to USD and CAD are as follows:

- ZAR10,50 : USD1
- ZAR11,05 : CAD1