Not all chemical gypsum is dumped. At Newcastle, some is taken away for making plaster or soil-conditioner.

Plaster products from a by-product

Plants that produce phosphoric acid from rock phosphate for fertilizer manufacture operate at Brisbane, Kwinana, Melbourne, and Newcastle, and together each year produce about 840 000 tonnes of chemical gypsum as a by-product. Most of it is dumped.

In Melbourne, the material is consigned to pits; at Kwinana it finishes up in Cockburn Sound; in Brisbane and Newcastle, small quantities of it are still discarded into the sea.

This year two more phosphoric acid plants — one at Kwinana and another at Geelong — are due to start operation, and the chemical gypsum will be disposed of in the sea.

Chemical gypsum, also known as by-product gypsum or phosphogypsum, is fairly benign. Some of the material not dumped (and some natural gypsum) is used as a soil-conditioner to break up clayey soil. The main reservation concerns the by-product's content of phosphoric acid, and of trace elements; its acidity may affect sensitive organisms.

Of the annual output of chemical gypsum, only about 150 000 tonnes escape dumping; some two-thirds of this is used for making gypsum plaster lining boards in New South Wales and Queensland, and the remainder for soil-conditioning. Yet we mine about a million tonnes of natural gypsum each year; why mine all this when so much chemical gypsum is discarded?

One good reason is that chemical gypsum contains a number of impurities — mainly phosphate, fluoride, and salts of aluminium and iron — that can cause difficulties in the manufacture of plasterboard (they make the plaster set too fast). Manufacturers of the product therefore prefer the natural material, or mix the chemical type with natural gypsum.

However, the cost of mined gypsum is increasing rapidly, principally due to the rising costs of energy and transport. Plaster manufacturers in the eastern States obtain their gypsum from mines in South Australia or from one at Mildura. Yet chemical gypsum is produced close by, virtually in their back yards.

Furthermore, environmental regulations are becoming stricter, and current disposal methods may not be allowed to continue indefinitely.

Mr Julius Beretka of the CSIRO Division of Building Research heads a team undertaking research to make sure that Australian industry can use chemical gypsum without the problems encountered to date. Japan, Germany, and Scandinavia have relied mainly on chemical gypsum for many years — keeping impurities at a low level by modifying the phosphoric acid process or purifying the gypsum by-product.

Mr Beretka considers that in the Australian situation the best approach is one that seeks to neutralize the interfering effects of impurities. Results obtained in his laboratory support the belief that this can be done easily and economically.

The main requirement is to add small quantities of quicklime to the chemical gypsum to neutralize the phosphoric acid residue. The mixture is then calcined (heated) like natural gypsum and lightly ground to a fine powder. Although the resulting plaster sets much too quickly, the addition of a commercial retarder readily overcomes that problem.

When mixed with water, the calcined chemical gypsum mixture produces plaster products similar in appearance and properties to

A chemical gypsum pond at Newcastle, N.S.W. Greater use could be made of this by-product.

those produced from the standard formulation.

They have about the same compressive strength, for example. However, the colour is slightly less white due to some organic impurities. Sheets of plasterboard reinforced with glass fibres are weaker when chemical gypsum is used, but Mr Beretka is confident that further work on the problem will yield a solution to this, too. He views the prospects for large-scale utilization of chemical gypsum as very favourable.

He has made a rough comparison of the costs of using natural and chemical gypsum, and chemical gypsum appears to be the winner.

Natural gypsum costs about $5 a tonne to mine. To this needs to be added the cost of transport, which varies from $5 to $30 a tonne depending on the distance moved. In principle, the cost of by-product gypsum is low, but the price would vary according to market requirements. Usually it would not need to be carried far, and at some locations its disposal in an environmentally acceptable way now costs at least $2 a tonne.

Natural gypsum is just about bone dry, so drying costs are minimal. However, chemical gypsum contains 10–30% water, and removal of this by heating costs about $5 per tonne if oil is used.

The rock gypsum needs to be well ground before calcinating, whereas the chemical sort does not, as it is already fairly fine. Chemical gypsum does need a little grinding after calcining, but this consumes much less energy than grinding rock.

The cost of the quicklime and commercial retarder, which appear to be necessary with chemical gypsum, is negligible.

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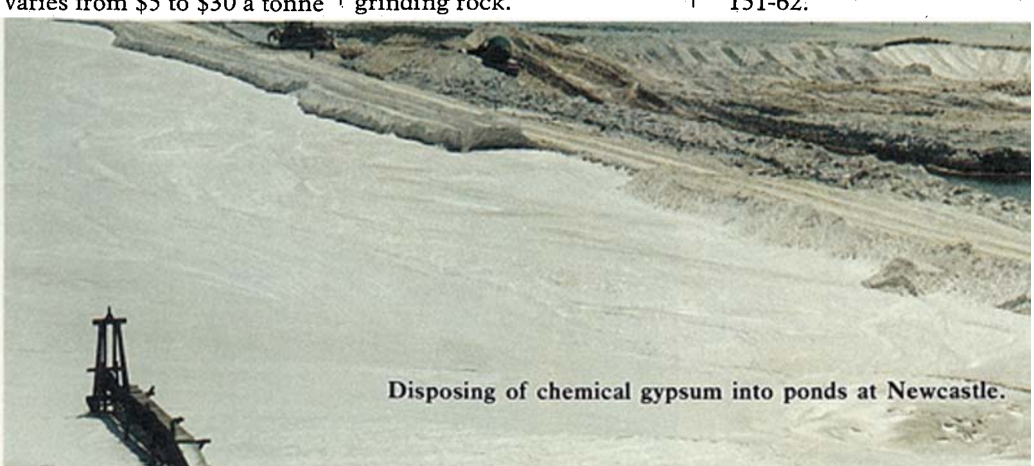

Disposing of chemical gypsum into ponds at Newcastle.