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OPTIMIZATION OF PHOSPHORIC ACID PRODUCTION COSTS BY THE APPLICATION OF MODERN TECHNOLOGY

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INTRODUCTION

PRAYON has been a producer of phosphoric acid for over 80 years. During this time there has been a gradual and progressive development of phosphoric acid and associated process technology and equipment. The fact that Prayon has always been principally a production company has meant that on-line time, low maintenance costs and low energy costs have also been important and as such the design of reliable equipment meeting these aims has always accompanied process innovation.

Four major revamps have been carried out by PRAYON at the Engis phosphoric acid site during the last 30 years to maintain its profitability in changing market conditions whilst satisfying more restrictive environmental requirements. This "in house" experience has, after testing, been made available to our clients throughout the world by the continual up dating of the licensed PRAYON technology. The development of equipment design during the last 50 years is quite remarkable and is only equalled by the developments in materials of construction during the same period.

The aim of this presentation is to outline some of the possibilities for revamping. However as PRAYON has already presented two papers on revamping at the IFA Technical Conferences in Tunisia and Venice this is only a superficial look at the problem and more details can be found in these original texts. [1,2].

Optimisations can be divided into several different classifications:

Rehabilitation of old or worn-out equipment.
The replacement with more modern equipment with superior performance Revamping with increase in capacity.
Increase in the size of the section limiting the capacity of the unit.
Revamping for compliance with stricter environmental constraints.
Modifications to the process or the addition of a fluorine recovery system.

1. Rehabilitation of old or worn-out equipment

The replacement with more modern equipment with superior performance

Many phosphoric acid units are reaching a phase in the life that although the reactor is still in good condition the ancillary equipment is beginning to reach the end of its life and the on-line time of the whole unit is compromised by the weaker links in the production chain. The on-line time affects the annual capacity of the unit and if this is reduced then the fixed costs applied to the lower annual capacity can make a unit Uneconomic. The replacement of such a unit by a completely new unit is often not an option due to the fact that normally a new unit requires a new operating permit which can delay or block the project but in any case it is often an expensive and time consuming burden.

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[1] *Paper presented at the IFA Technical Sub-Committee and Committee Meeting, 15-17 September 1999, Novgorod, Russia*

If old and worn-out equipment is to be replaced then the impact of the substitution must be analysed with respect to the relative potential capacities of all the other components in the production train to be able to optimise the. overall profitability of the investment.

Each component's maximum potential should be analysed so that the whole should not be limited by another inexpensive component

- Grinding & phosphate handling
- Reactors
- Agitators
- Sulphuric acid dilution units
- Air cooling
- Flash-coolers
- Flash-cooler circulation pumps
- Slurry pumps
- Filtration section
- Cooling water circuit
- Gypsum disposal system

2. Revamping with increase in capacity

Increase in the size of the sections limiting the capacity of the unit.

A similar study is required if a revamping is being effected to increase the overall capacity of the unit. In fact a revamping is very difficult to justify solely to increase the efficiency of an old unit. An increase in instantaneous capacity, in times when acid prices are high, often gives the financial justification that is required to make such an investment.

Often an increase in capacity can be made by substitution of an existing filter by one of a larger size and improved performance within the same envelope or building without excessive civil costs. Alternatively an additional filter, often a belt filter, can be added to increase the filter area but this often implies the construction of another building or annexe. Once again a technical audit of the plant must be made to verify if the other components are compatible with such an increase to be able to get the most out of such an investment.

3. Revamping for compliance with stricter environmental constraints

Modifications to the process or the addition of a fluorine recovery

Either new legislation or local public pressure can cause companies to look into the possibility of improving the environmental performance of a complex. Thus many revamps are now required due to reduce effluents, both gaseous and liquid, making the phosphate complexes more environmentally friendly. Some of these changes are listed below but this is by no means exhaustive.

- Wet phosphate feed to reduce dust and consume liquid effluents
- Modifications to water circuits to reduce emissions
- Upgrading of the gas scrubbing systems
- Introduction of fluorine recovery systems
- Improvements to, or changes in, the process to produce a cleaner gypsum
- Modifications to gypsum discharge system

PRAYON offers consultancy in all these areas and can also, based on its extensive experience, do Environmental Impact studies for both new and existing plants. The latest gas scrubbing and fluorine recovery systems offered by PRAYON are compact and lend themselves well as add-ons to an existing unit

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