

Uhde innovate 2024

Phosphogypsum – Low emission calcination process for CO₂ Capture

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Phosphogypsum ?



Phosphate Rock

Sedimentary rock:
(e.g. Apatite: $\text{Ca}_5[(\text{F}, \text{OH}, \text{CO}_3)/(\text{PO}_4)_3]$)

Phosphoric
Acid Plant

H_2SO_4

Sulfuric Acid
Plant

Phosphoric Acid

Sulfur



Phosphogypsum

Quantity:

- 4 – 5 to PG / to of Phosphate product
- Worldwide ~ 250 Mio to/year

Composition:

- ~ 95 % Gypsum (CaSO_4)
- + Impurities (P_2O_5 , F, Sulfates)
- + Heavy Metals,
- + Rare Earth Elements (Radioactive Elements)

Disposal of Phosphogypsum:

- Due to contamination: environmentally harmful waste
- High cost for landfill / disposal
- Sulfur / P_2O_5 completely lost
- No access to other valuable elements

Phosphogypsum causes environmental and commercial problems



Phosphogypsum landfill

Phosphogypsum sea disposal



Uhde & Polysius Technology Reference: Müller-Kühne and Krupp-OSW Processes

Phosphogypsum

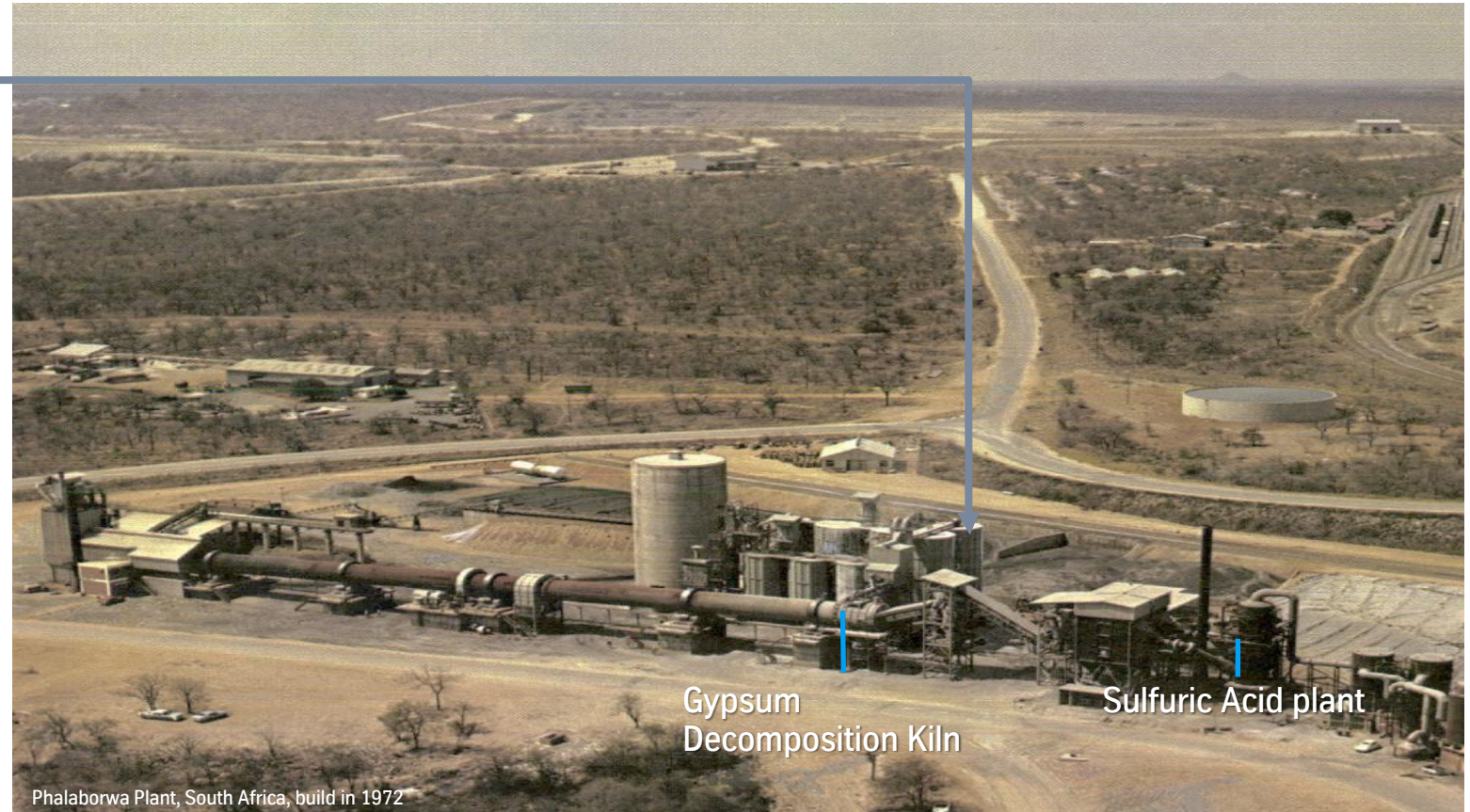
Phosphogypsum Reference Plants (e.g.):

- Austria (Chemie Linz)
- Poland (Wisow)
- South Africa (Phalaborwa)

Weak Points:

- Environmental limits
- Quality of Clinker (Cement)
- Energy Consumption

➔ Consequently, the technology was developed further



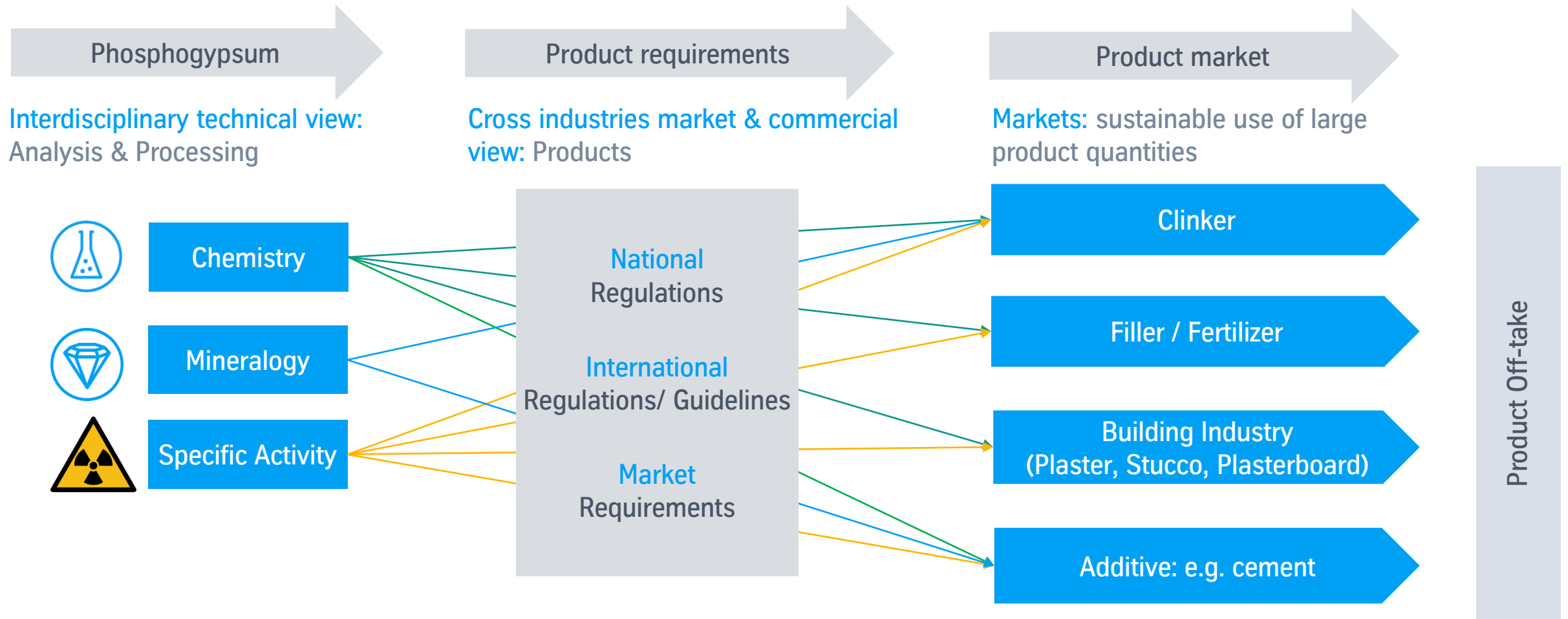
Phalaborwa Plant, South Africa, build in 1972

Experience in recycling of Phosphogypsum to Sulfuric Acid and Clinker



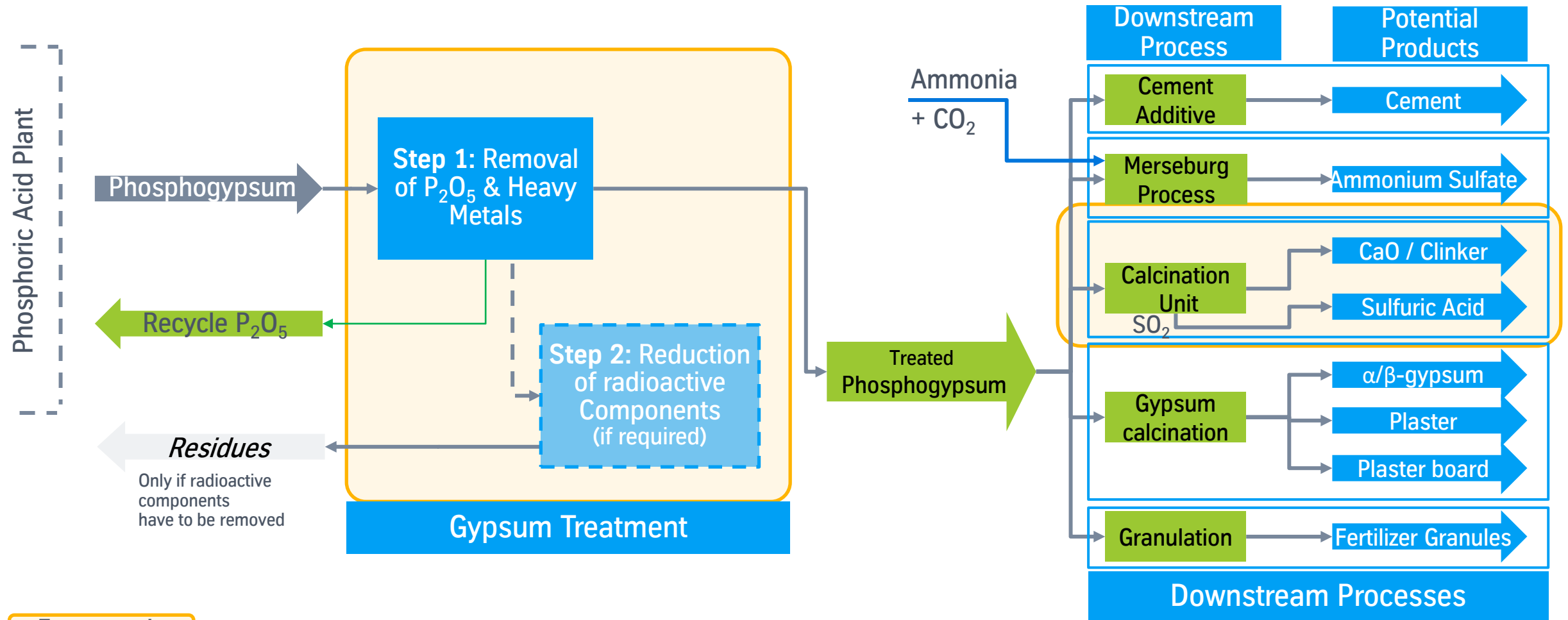
Process upgrade: Requirements for Phosphogypsum product quality?

Interdisciplinary view: environmental, technical, economical, regulatory & cross industries



Uhde's upgraded Phosphogypsum Process Concept

Phosphogypsum Treatment & Downstream Process

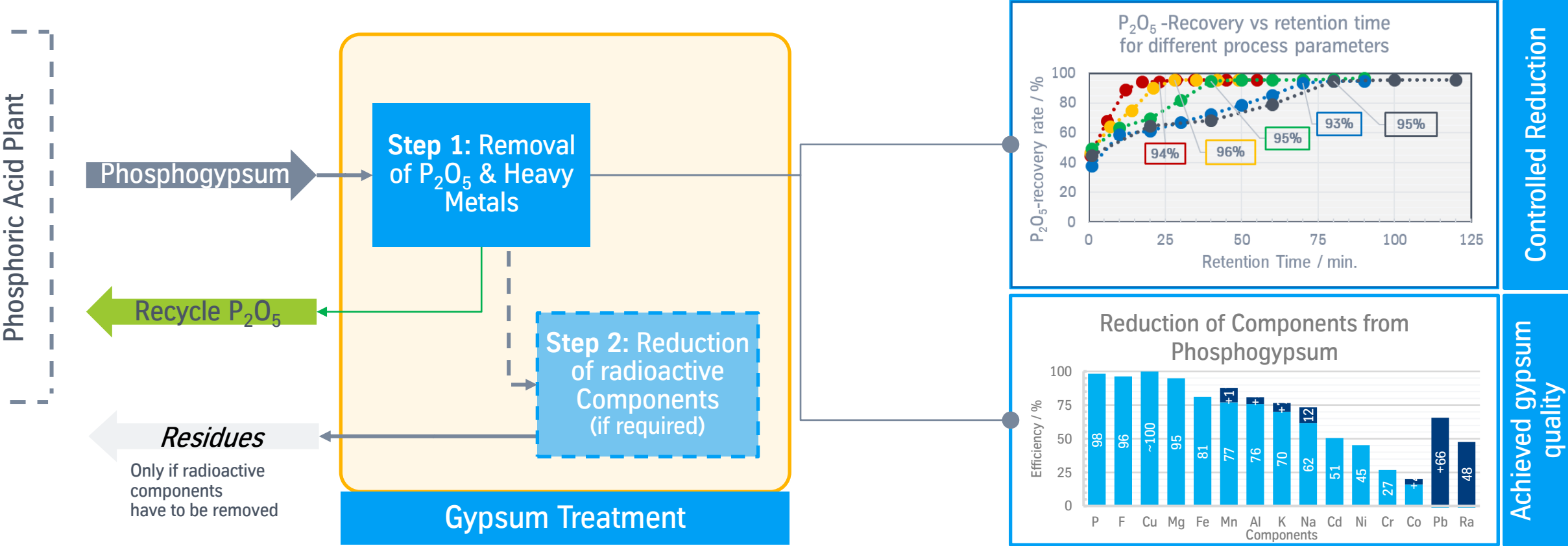


Focus topic



Phosphogypsum Treatment

Phosphogypsum Treatment Efficiency



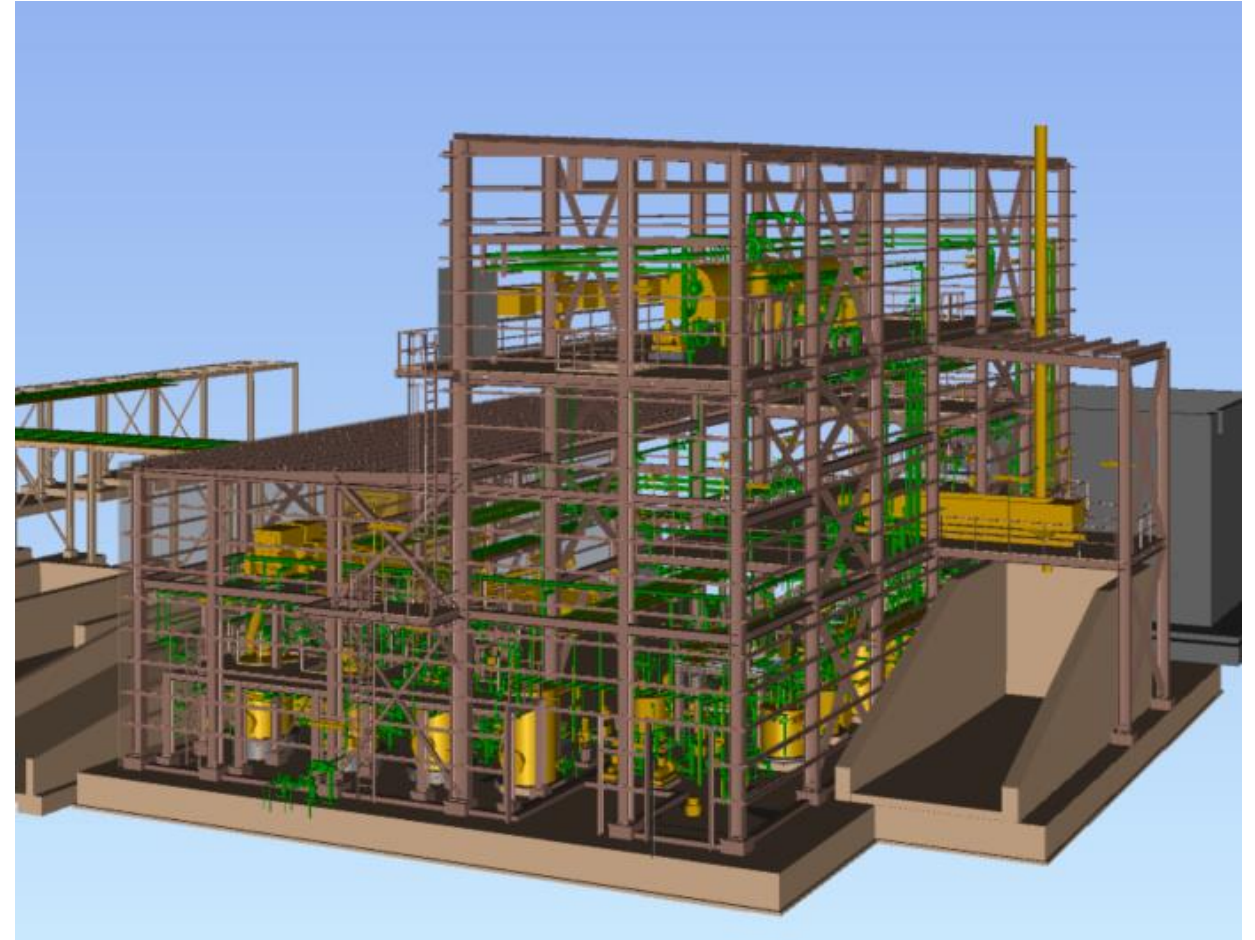
Treatment parameters depend on produced phosphogypsum and required gypsum quality



Current activity (1): Phosphogypsum Treatment Pilot plant in Partnership with NCIC Egypt

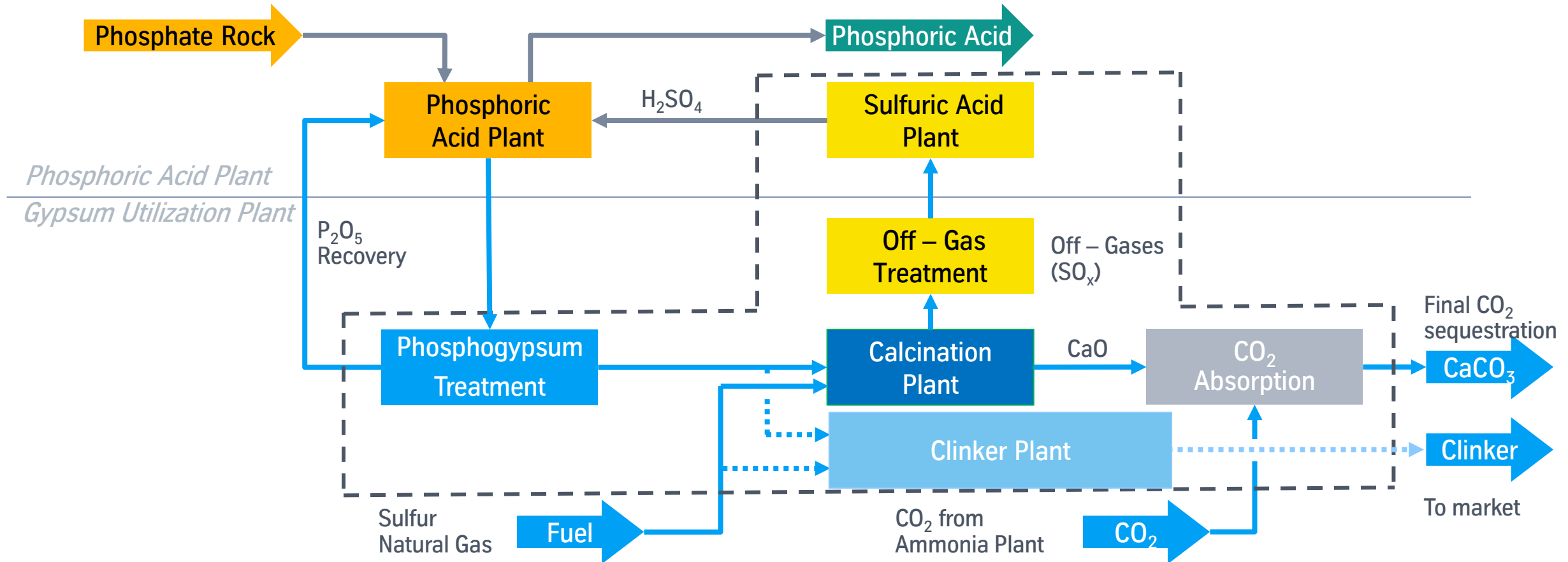


Cooperation Agreement with NCIC – Pilot Plant



Pilot Plant – Continuous operation of 60 tpd

Utilization of Phosphogypsum Ma'aden: Project Scope Details



Utilization of Phosphogypsum: Elimination of waste, Recycling of Phosphogypsum & CO₂ Removal

... option



Current activity (2): Phosphogypsum Utilization in Partnership with Ma'aden Saudi Arabia

Jan 10, 2024 2:00 PM

thyssenkrupp Uhde signs Master Agreement with Ma'aden and Metso on phosphogypsum recycling and CO₂ capture project

Joint development of environmentally friendly solution

Low-emission calcination process enables CO₂ capture in limestone



Summary

The utilization of phosphogypsum is possible, environmental friendly and economical feasible.

The process design is Phosphogypsum specific.

Tailor made solutions are required.

Phosphogypsum Utilization: Recovery of P_2O_5 recovery, Saving of landfill cost, fulfilling of environmental & permitting requirements

**thyssenkrupp
Uhde & Polysius
can do it.**



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Uhde and Polysius have the unique technology solution to solving a major challenge for the industry





Thank you for your attention



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