

## SOP – A precious by-product for solar salt works



World Salt Symposium

June 2018 | Park City UT, USA



- ❖ K-UTEC AG Salt Technologies
- ❖ Introduction
- ❖ Bittern Utilisation
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## K-UTEC AG Salt Technologies

**Foundation of Potash Research Institute of GDR** 1951

**Foundation of K-UTEC GmbH** 1992

**Spin-off of K-UTEC AG Salt Technologies** 2008

**Management Board**

Dr Heiner Marx  
Dr Volker Asemann  
Dr Markus Pfänder

**Employees**

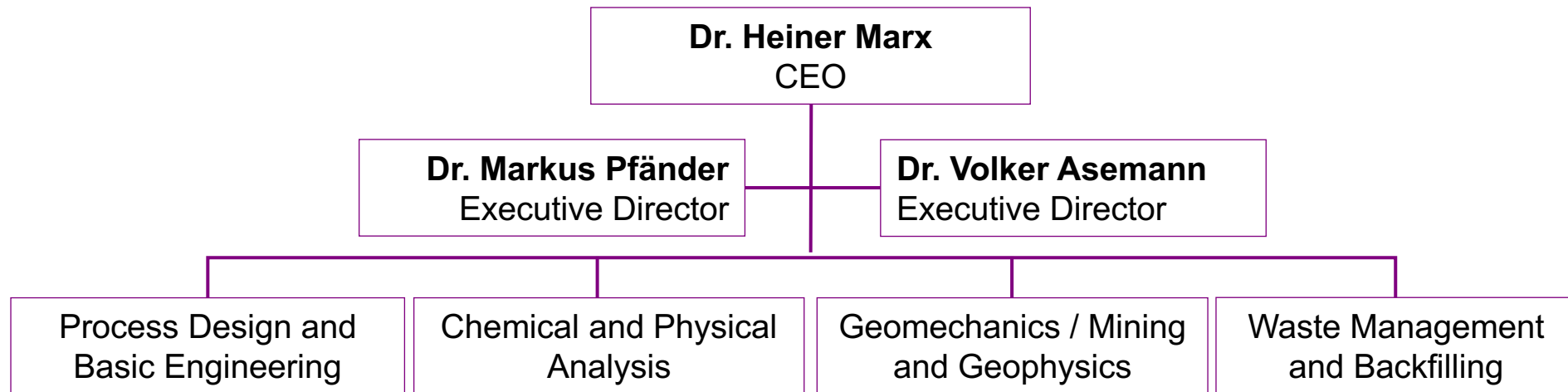
100



**Competence in Salt**



## Organization



**More than 67 Years Experience In Mineral Salt Industry**





## K-UTEC Test Field (Area 700 m<sup>2</sup>)





Australia  
Argentina  
Austria  
Belarus  
Bolivia  
Botswana

Brazil  
Chile  
China  
Egypt  
Eritrea  
Ethiopia  
France  
Ghana  
Hungary  
India  
Iran  
Laos  
Mexico  
Peru  
Russia  
Saudi Arabia  
Spain  
Thailand  
Tunisia  
United Kingdom  
USA

United Kingdom  
USA

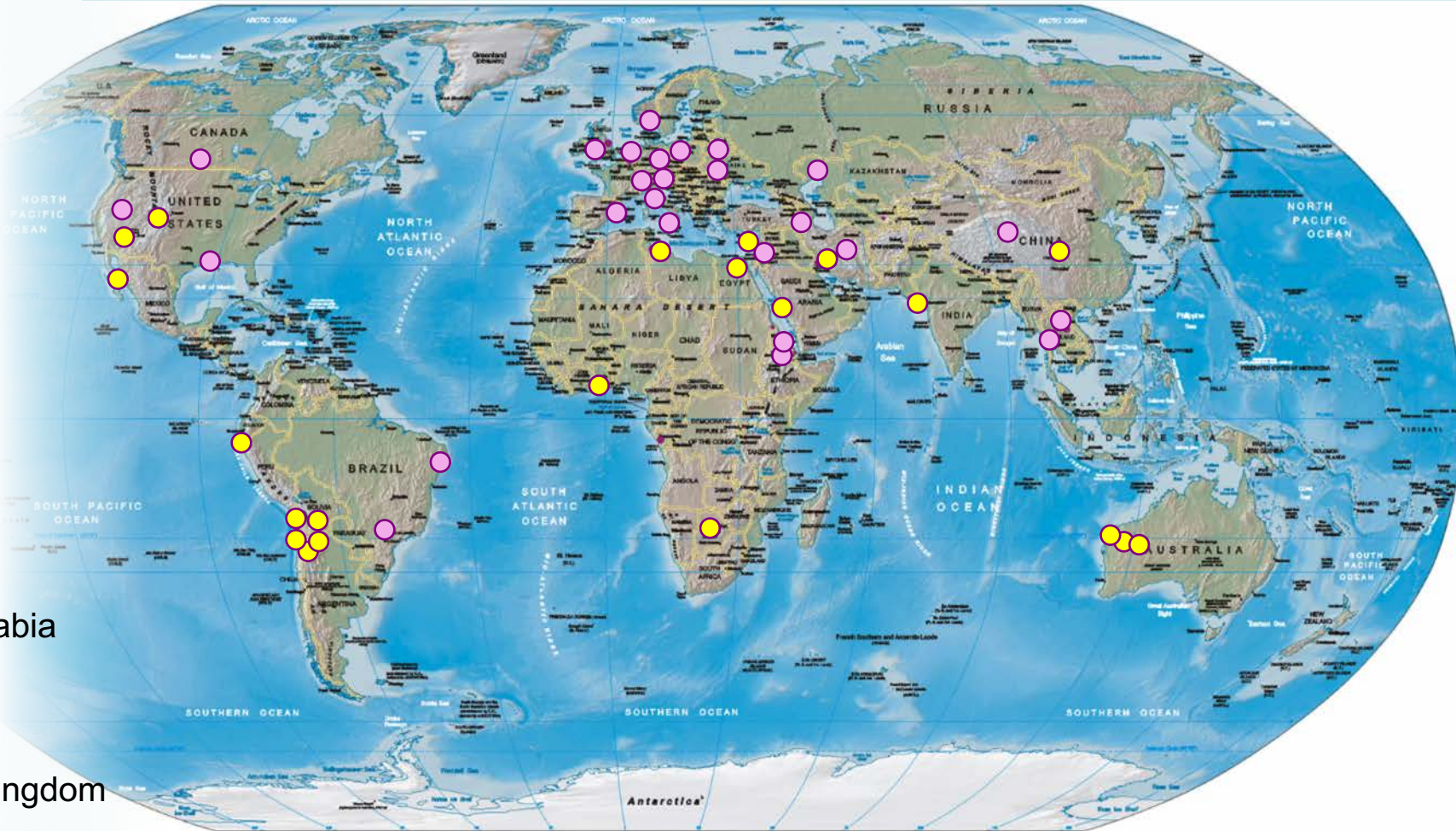
WORLD | SALT SYMPOSIUM



**June 19-21, 2018**

**Park City UT, USA**

## K-UTEC's Projects Worldwide



● Brine Deposits    ● Solid Deposits

- Solid Deposits



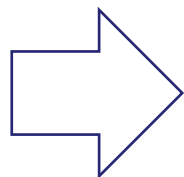
\* Mining valuable minerals from seawater: a critical review, P. Loganathan, G. Naidu and S. Vigneswaran, Environ. Sci.: Water Res. Technol., 2017, 3, 37



## Solar Salt Production – Main Process Steps

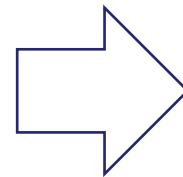


Pumping

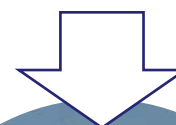


Solar Evaporation

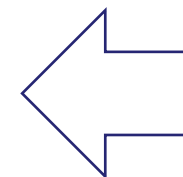
Concentration and Crystallisation Ponds



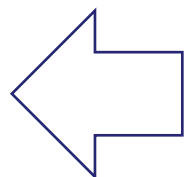
Harvesting



Stockpiling



Salt Washing



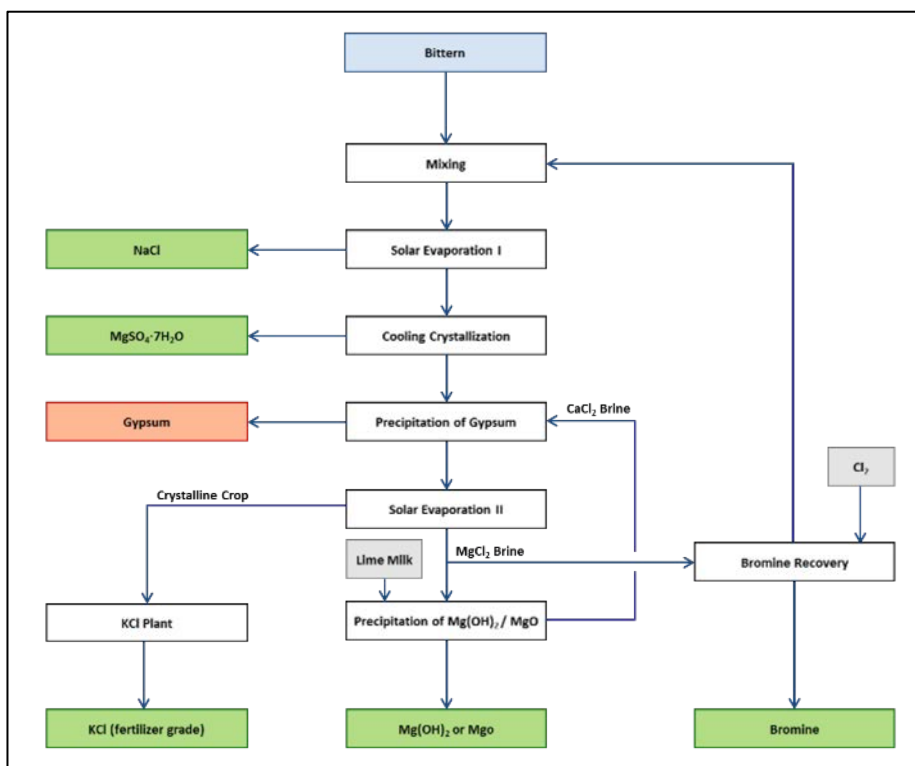
Sea Water

NaCl  
> 99 %

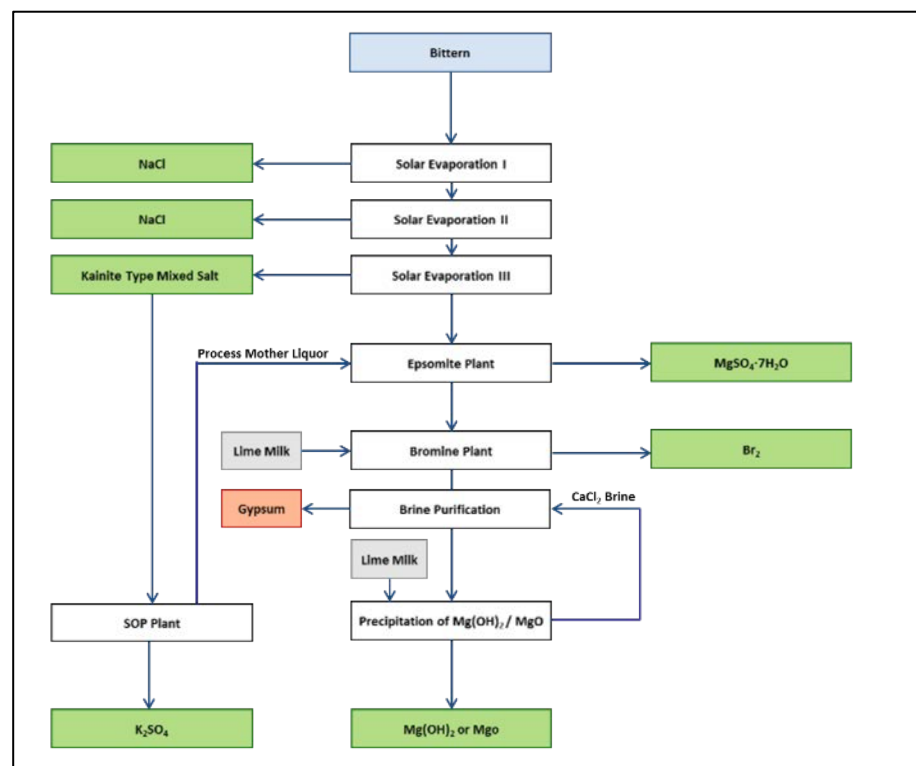


## Possibilities for Utilisation of Remaining (Sea) Bittern

### MOP Process Route



### SOP Process Route





## Possibilities for Utilisation of Remaining (Sea) Bittern (cont.)



### Potential Products

$\text{NaCl}$

$\text{KCl}$  (MOP) **or**  $\text{K}_2\text{SO}_4$  (SOP)

$\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$

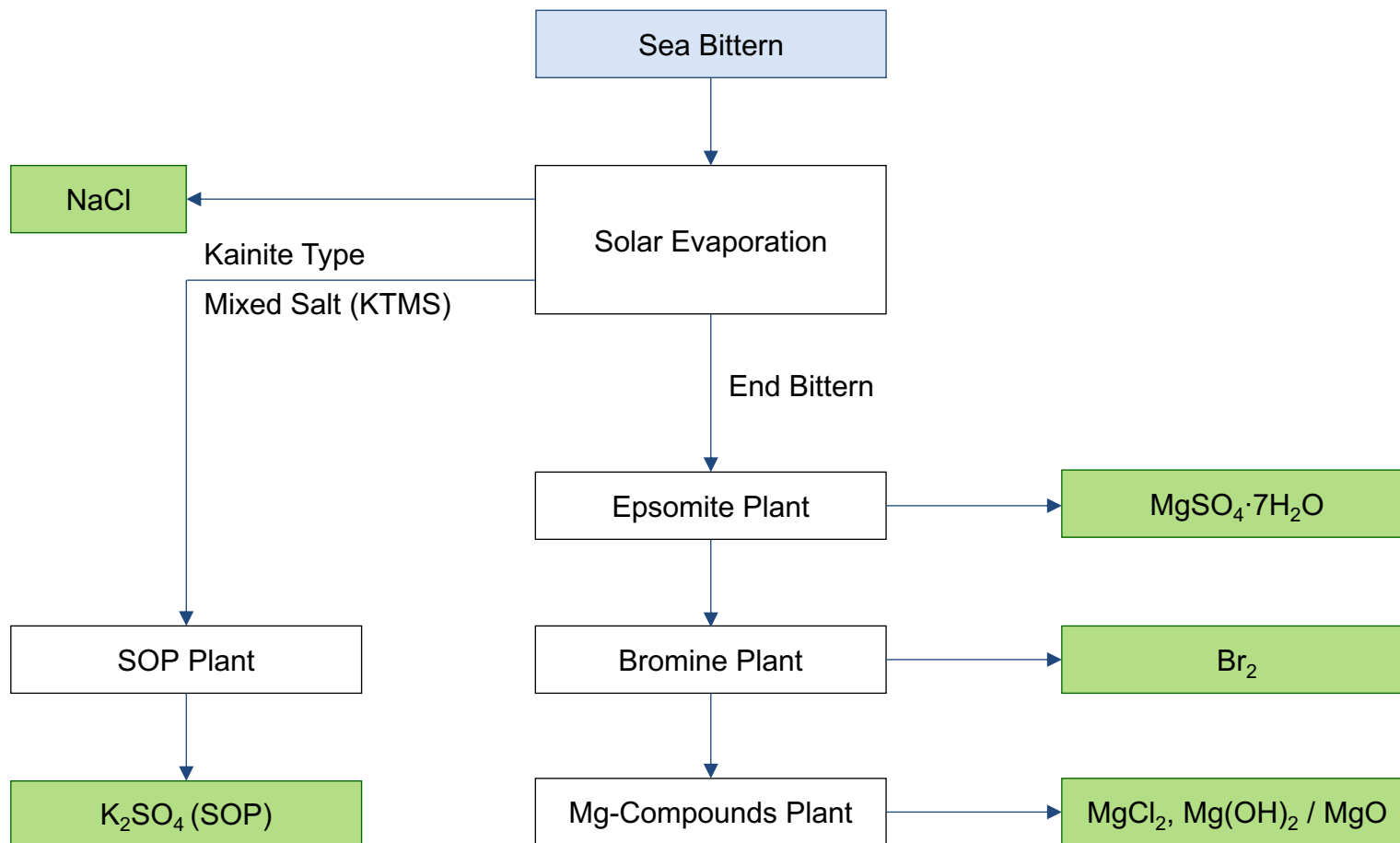
$\text{MgCl}_2 \cdot 6\text{H}_2\text{O}$  |  $\text{Mg}(\text{OH})_2$  |  $\text{MgO}$

$\text{Br}_2$



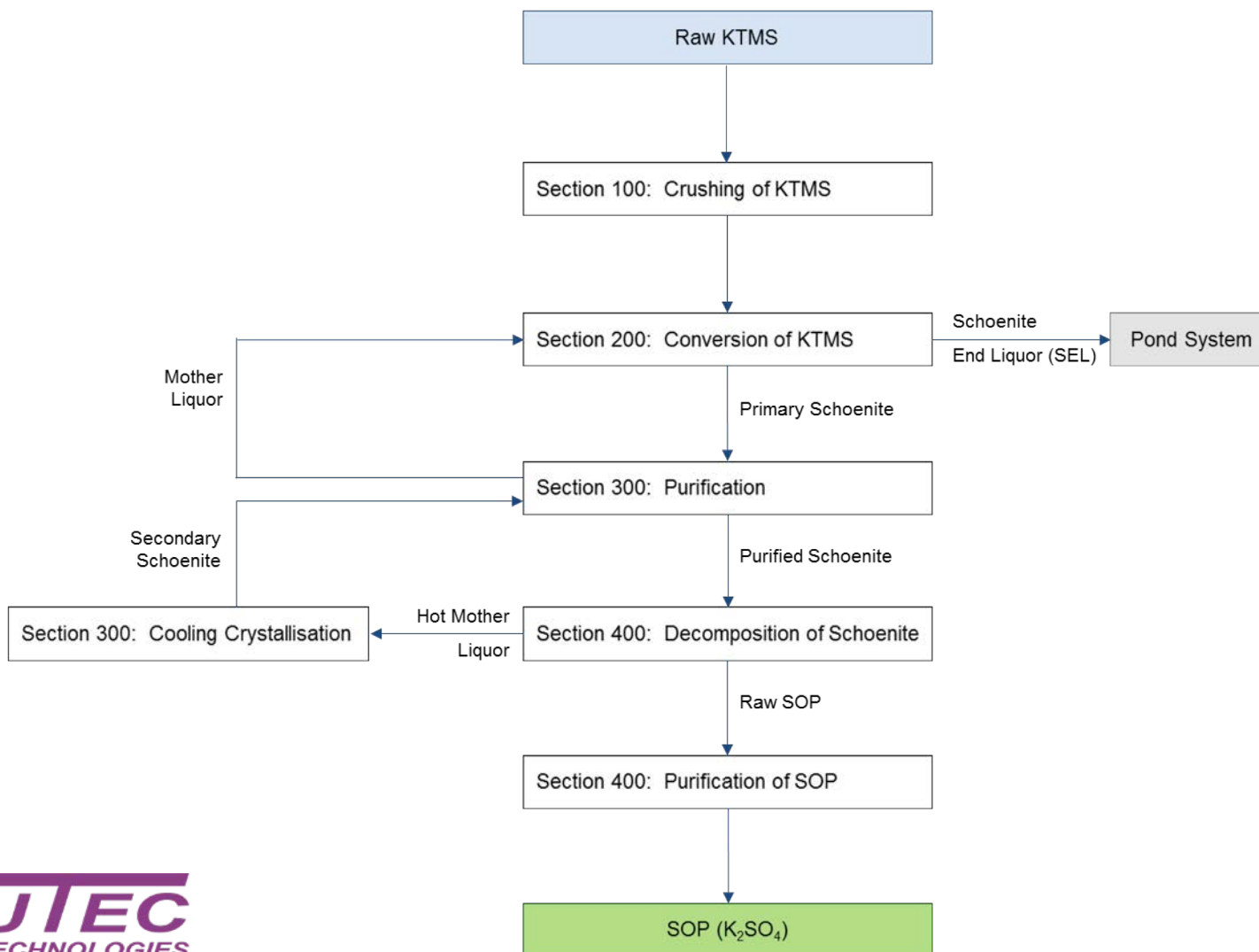


## SOP Route | General Process Scheme





## SOP Route | General Process Scheme





## Approximate Product Quantities for Salt Work Capacity of 1 Mio t NaCl

**Resulting Bittern: 2 Mio t**

MOP Route	SOP Route
380 kt/a NaCl	380 kt/a NaCl
140 kt/a $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$	100 kt/a $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$
29 kt/a KCl	34 kt/a $\text{K}_2\text{SO}_4$
78 kt/a $\text{Mg}(\text{OH})_2$	89 kt/a $\text{Mg}(\text{OH})_2$
2.3 kt/a Bromine	2.2 kt/a Bromine



## Project example – SOP Plant India Great Rann of Kutch

### Design Parameters:

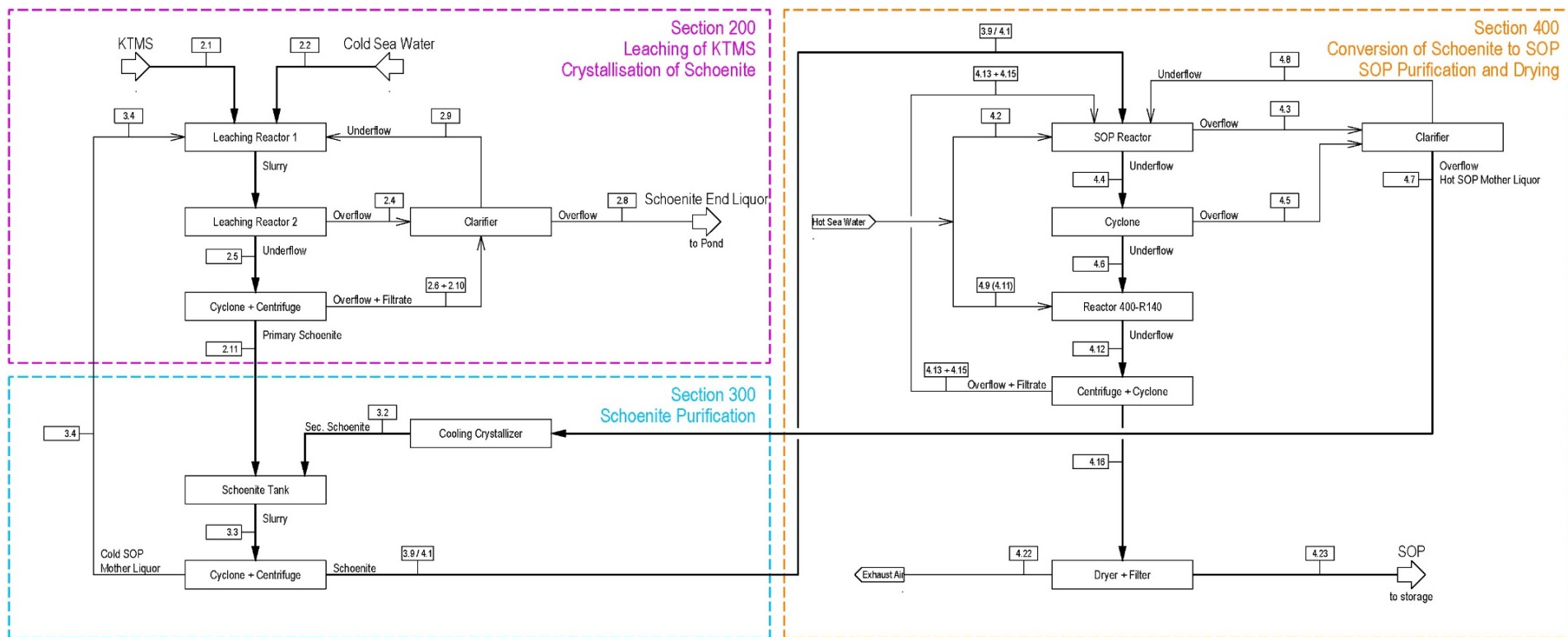
Product		Phase I	Phase II
SOP	[kt/a]	100	300
Bromine	[kt/a]	15	35
NaCl	[kt/a]	5,000	10,000
Epsomite	[kt/a]	94	282

### K-UTEC AG's Scope of Work:

Process Design and Basic Engineering  
 Bench Scale Test Work  
 Support with Commissioning and Start-up

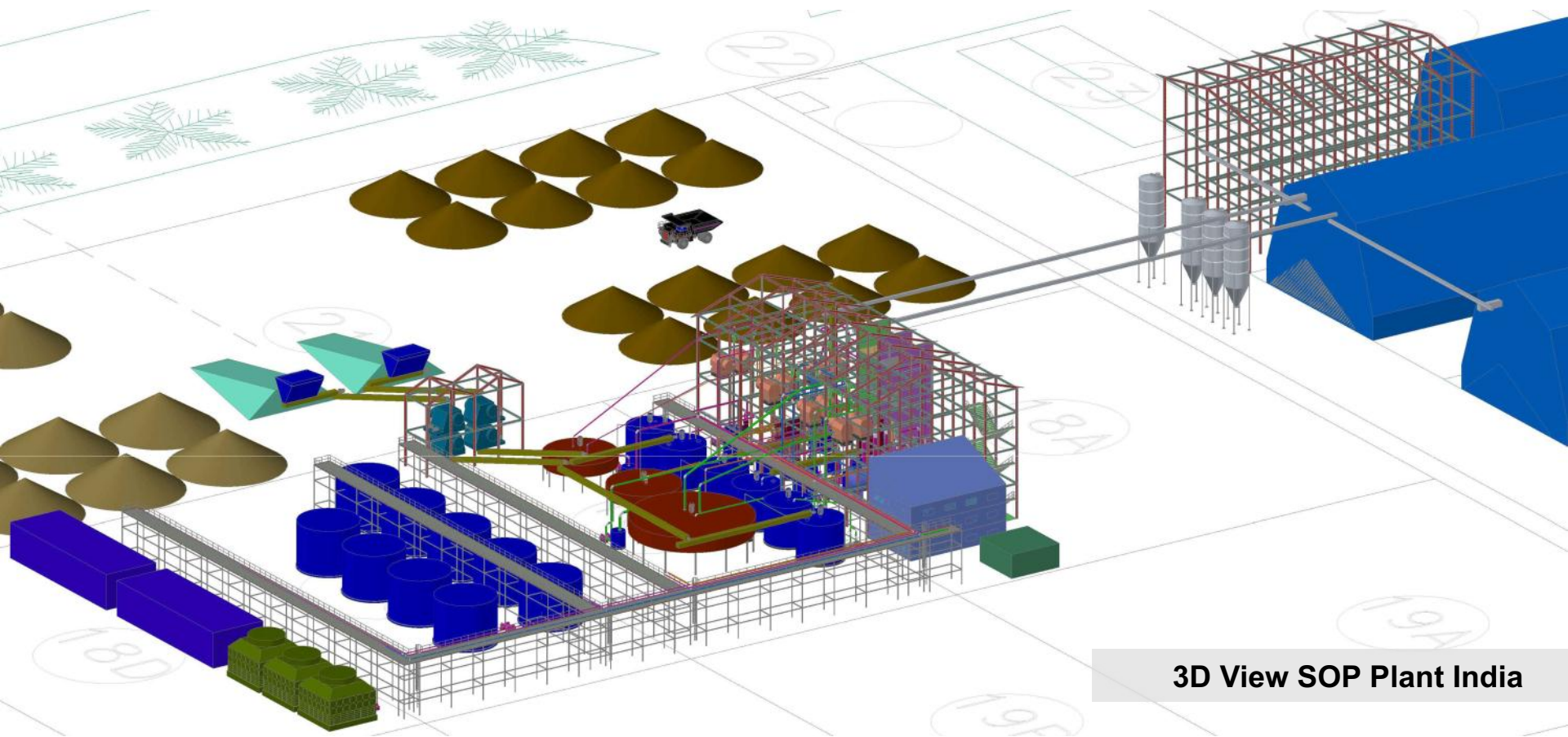


## SOP Plant India Great Rann of Kutch – Process Flow Diagramm





## SOP Plant India Great Rann of Kutch – Engineering



3D View SOP Plant India



## SOP Plant India Great Rann of Kutch – First Production of SOP in March 2015





## Selected References

- |             |  |
|-------------|--|
| 2018        | <b>Comprehensive Utilisation of sea bittern resulting from sea salt production in Western Australia</b><br>Scoping Study<br>BCI Minerals / Australia                                       |
| 2015-2018   | <b>Comprehensive Utilisation of Beyondie Brine / Western Australia</b><br>Pre Feasibility, Feasibility Study and Engineering Management<br>KLP / Australia                                 |
| 2009 - 2015 | <b>Production of <math>K_2SO_4</math> and <math>MgSO_4 \cdot 7H_2O</math> based on sea brine from Rann of Kutch</b><br>Process Design, Basic Engineering, Commissioning<br>Archean / India |
| 2014 - 2015 | <b>Recovery of valuable components from sea bittern resulting from sea salt production in Baja California, Mexico</b><br>Scoping Study<br>Packsys S.A. / Mexico                            |
| 2011 - 2013 | <b>Integrated plant to produce SOP, MgO, DCP and Bromine from Cañamac brine</b><br>Process Design and Basic Engineering<br>SALSUD / Peru   |
| 2011        | <b>Expertise for potential utilisation of waste brines in “Werra Revier” on a theoretical base and creation of suitable concepts</b><br>Conceptual Study<br>K+S Kali GmbH / Germany        |





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