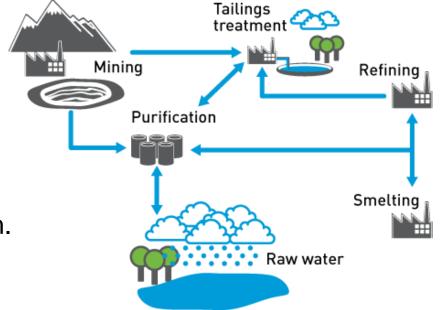# HSC Chemistry in the mining area water balance calculations

Tuukka Kotiranta

Content of the presentation

- Water & mining industry
- What is HSC Chemistry?
- How HSC Sim can be used?
- Steady state simulation.
- Importing initial data to HSC Sim.
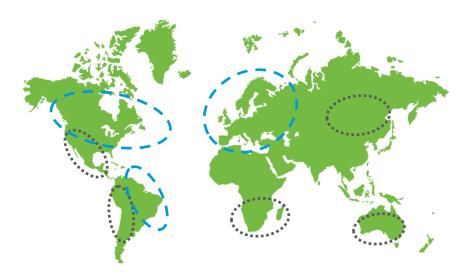- Simple example
- HSC Sim future development

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Water & Mining Industry

- Water can be a limiting factor in developing and ongoing mining operations

- Water availability is no longer guaranteed and consumption needs to be carefully considered and planned

- Many mining operations are located in areas of water stress, where it is crucial to reuse and recycle water within operations.

- Some regions may have a surplus of water, due to high rainfall, leading to issues associated with storage and disposal on site.

- Current trend of ever tightening environmental regulations lead to the need for more advanced treatment technologies

Mining in water stress areas

Mining in water surplus regions / areas having push towards tighter environmental regulations

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Introduction

- HSC Chemistry is a program that contains over 20 modules and the simulation tool (Sim) is one of them.
  - All modules are independent programs that are made for calculation of specific situation, for example: equilibrium composition, eH pH diagrams, heat transfer through a wall, etc.
- Sim module is one of the most resent modules published in 2006.
- The simulator has been developed for metallurgical application in mind, but can be used for similar processes.
- Sim has three type of units: reactions, distributions and particles.
  - Reactions are based on reaction equations (hydrometallurgy).
  - Distributions are based on element distributions (pyrometallurgy).
  - Particles are based on particle size and distribution (minerals processing).
- Process units are Excel files.

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HSC Sim

- HSC Sim is a steady state simulator.

- Water balance with impurities can be calculated with steady state simulator, but the result is the impurity level after few years.

- The rate of change needs to be calculated with other methods.

- If most of the solution goes through the tailings pond you will need separate calculations for winter time and summer time. Or you can calculate the situation on monthly basis.

- For multiple calculations HSC Sim has a scenario tool that needs the changed values as inputs and the result values as outputs. The methodology is the same as importing information that is presented in the next slides.

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HSC Sim in the mining area water balance calculations

- The water balance is very important for the mining areas and simulation is useful if waters with different quality are going to be put to the same place.

- When we calculate the process we get the water quality after the process and see how the process affects on the water quality.

- Water treatment circuit capacity can be tested with different scenarios.

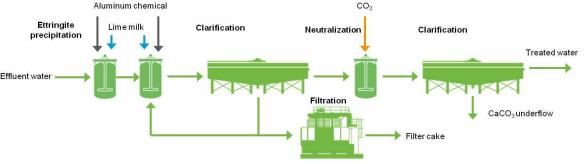- We can also test different ideas with the process model, like what happens if we filter the tailings.

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Importing information to HSC Sim

- In HSC Sim all units are Excel files and additional sheets can be added to the units or tables can be added to the flow sheet.

- Information that model needs can be collected to one place and it can be updated by copying the data on top of old one.

- Copy and paste method is currently the best.

Aluminum chemical

CO_2

Ettringite precipitation

Lime milk

Clarification

Neutralization

Clarification

Treated water

Effluent water

Filtration

$CaCO_3$ underflow
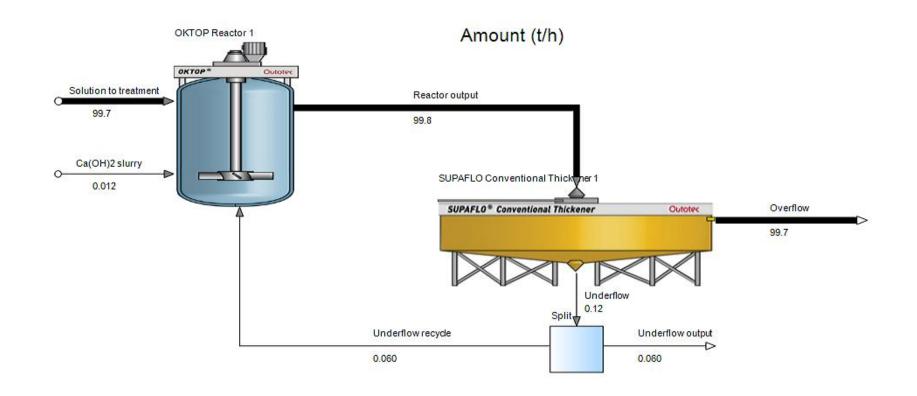
Filter cake

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Short example

- The idea of this example is to show what is easy to make with HSC Sim. This is something that anyone can make after two days of training.

- The complexity of the model depends on the complexity of the modeled process and in real cases it means quite complex models. Usually it is good to start with a simple model.

- In this example copper is precipitated with $Ca(OH)_2$ slurry.

- The input values for the process are collected to one table to enable the importing information easily.
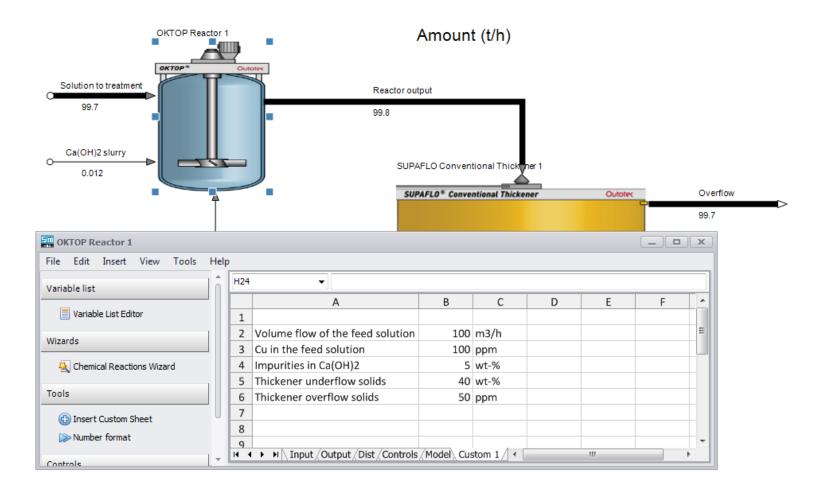
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Example flow sheet

Example of the input data sheet

Future development of HSC Sim

- HSC is developed continuously. We add new features and improve the usability of the old ones.

- HSC is widely used inside Outotec and new functionality is often developed from our own needs.

- New features that will be added to HSC Sim shortly, in about half a year, beta version stage:
  - Dynamic calculation.
  - Possibility to make own DLL type model.

- New features that are under development stage, current time schedule is about one or two years:
  - Process unit, possibility to load and save a process area. Makes possible to simulate plant units and use them inside a new process. Advantage: you need to simulate one plant unit once and you can reuse that.
  - Monte Carlo calculation.
  - OPC connectivity to the automation system or other systems.

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Thanks for your attention!

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