Our Services

- Hydrometallurgical Process Development
- Geological and mineralogical sample characterization
- Ore grade determination and distribution
- Minerals processing tests and engineering
- Chemical engineering
- Advanced computer simulations to optimize leaching kinetics (3D reactive transport model for percolate/saturated conditions by in-house software KiLea and TRN)
- Optimization of recovery grades
- Testing and development of hydrometallurgical processes within integrated flow sheets according to your requirements
- Analysis and separation of NORM, as well as integration of NORM removal within the flow sheet
- Integral solutions by considering the whole process chain from ore sampling, processing, disposal and final remediation of the mine site by simulating and engineering the entire process from mining to a marketable metal concentrate
- Testing and evaluation of the most efficient and economic extraction method (tank/heap/in-situ leaching) for a specific ore body under the local conditions (geomorphology, infrastructure, climate, legal issues, etc.)

UMWELTLEISTUNGEN
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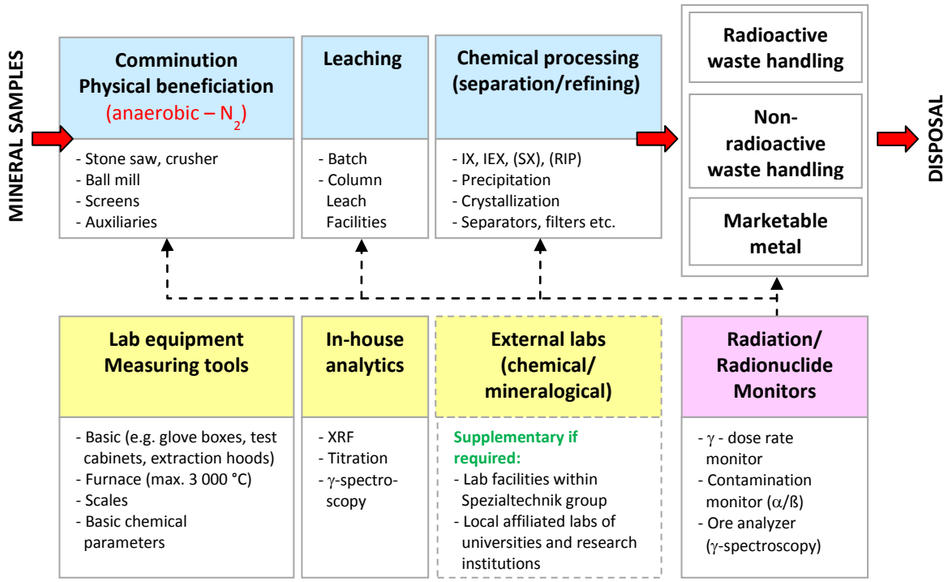
Mineral Resources Technical Center for Hydrometallurgy and NORM Separation

VERSION DATE – 01/09/15

Processing of Technology Metals

Specialized in-house flow sheet for the processing of minerals containing **technology metals associated** with **NORM** (**N**aturally **O**ccurring **R**adioactive **M**aterial).



Comminution and Analytics

Reproducible sample preparation is ensured by crushing, grinding, sieving, homogenization and mechanical beneficiation (gravimetric, magnetic) with **most modern lab instruments** in order to facilitate a reliable sample analysis. The geochemistry is determined by **XRF** (most elements) and a **basic ore characterization** is realized by ore microscopy of polished sections or grain samples. If necessary, additional analyses such as ICP-MS/AES, SEM or MLA are carried out by our affiliate laboratories. Generally, the facilities of the technical center provide contamination-free and reliable sample preparation **optimized and certified for NORM samples**.

Jaw crusher

Ball mill

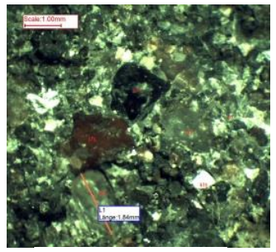
Sieve (4 mm – 25 µm)

Sample powder

Niton FXL analyzer

Radiometer

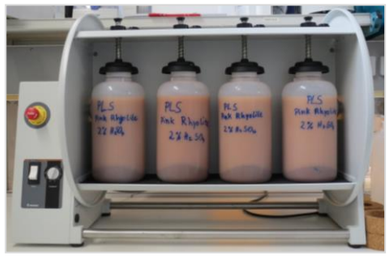
Zeiss ore microscope



Microscope image of uranium ore

Tank/Heap/In-situ Leaching Studies

Industrial (hydro)-metallurgical processing options are investigated at lab-scale and are simulated by chemical processing models for up-scaling. **Tank, heap and in-situ leaching** is tested by **batch experiments** (beaker, bottle-roll, autoclave) and **column leach test facilities** (percolate/saturated).



Bottle-roll facility

Autoclave

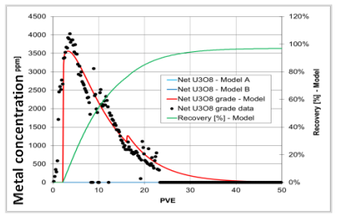
Batch leach tests are performed in **dependence on physical** (temperature, pressure) and **chemical parameters** (pH, ORP, EC, specific ion concentrations). The bottle-roll facility simulates ambient conditions and the autoclave works up to 250°C and 20 MPa.

- Anaerobic column preparation (N_2)
- 3-channel high-precision peristaltic feed pump
- 3-channel temperature control
- 3 parallel columns (horizontal or vertical)
- In-line measurement of pH, ORP, EC, (I), p
- Injection leachant reservoirs
- Leachate collectors for sampling

The column leach test facility (saturated flow) is designed according to international standards, operating a 3-channel system either in horizontal or vertical flow. Operational parameters in accordance to **realistic ISL wellfield conditions** (aquifer temperature, pore volume exchange rate) monitored by real-time data logging/control.

Percolate column leach test facility

IX resin test



Ideal leaching kinetics

Percolate column leach tests are performed under ambient physical conditions in order to **simulate heap leaching**. Performance depends on chemical parameters, unsaturated flow conditions and additional parameters (e.g. particle size distribution, homogeneity, porosity). Test results enable **up-scaling of an ideal reactive transport model to real-world scenarios**.

We know that reliable and convincing test results are very important to our clients and therefore we are providing all services from onsite visits, sampling to optimized leaching kinetics and a wholly integrated hydrometallurgical process.

In combination with our professional environmental monitoring staff, we offer plausible and smart-technology solutions, from holistic conceptual design to cost-saving implementation. In cooperation with our local agents we can also provide a full EPCM solution and offer the required services for a smooth operation in the long run.

Contact us, we will listen to your needs and work out a solution to fit your technical requirements, your budget and your timeline.

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