



/ Webinar Eco Mining Concepts, 17 June 2020

MAXIMISING RE-USE AND RESOURCE EFFICIENCY OF MINING ASSETS: BEST PRACTICE EXAMPLES FROM THE POTASH INDUSTRY TO INSPIRE OTHERS

ANA OELLERMANN, TOBIAS PINKSE

K-UTEC
SALT TECHNOLOGIES



**SCHACHTBAU
NORDHAUSEN**

K-UTEC AG SALT TECHNOLOGIES

Introduction



- Foundation of the Potash Research Institute of the German Democratic Republic (DDR) 1951
- Foundation of K-UTEC GmbH 1992
- Formation of K-UTEC AG Salt Technologies 2008
- Management Board Dr. Heiner Marx
Dr. Markus Pfänder
- Employees Circa 100



WWW.K-UTEC.DE

COMPETENCE IN SALT

SCHACHTBAU NORDHAUSEN

Introduction

- Based in the city Nordhausen, Germany
- Established in 1898
- Since 1992 a part of the BAUER Group
- Businesses in 5 core areas:
 - **Mining** and Plant Engineering
 - Mechanical Engineering
 - Construction
 - Sanitation
 - Steel Construction
- Turnover: 142 m€ in 2018
- Employees: more than 1.000

K-UTEC
SALT TECHNOLOGIES



SCHACHTBAU NORDHAUSEN

Business Area - Mining - Development of Underground Mining

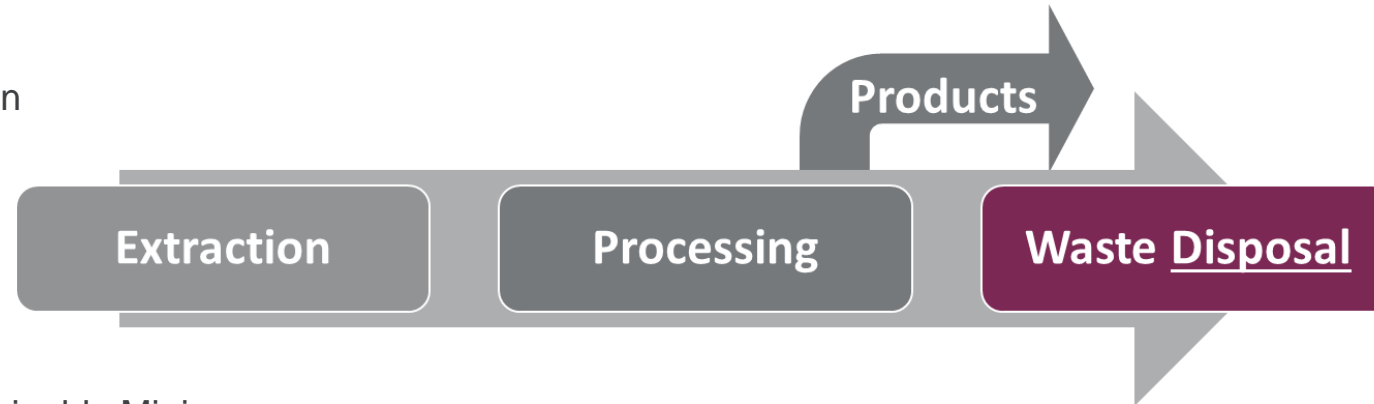
- Drifting, heading, roadway and slope development
- Shaft sinking, lining and support
- Wide range of stabilization and securing methods
- Shotcrete and anchor works, steel and wood support
- Sealing and grouting works
- Mining and wastewater treatment handling
- **Mine closure and backfilling**



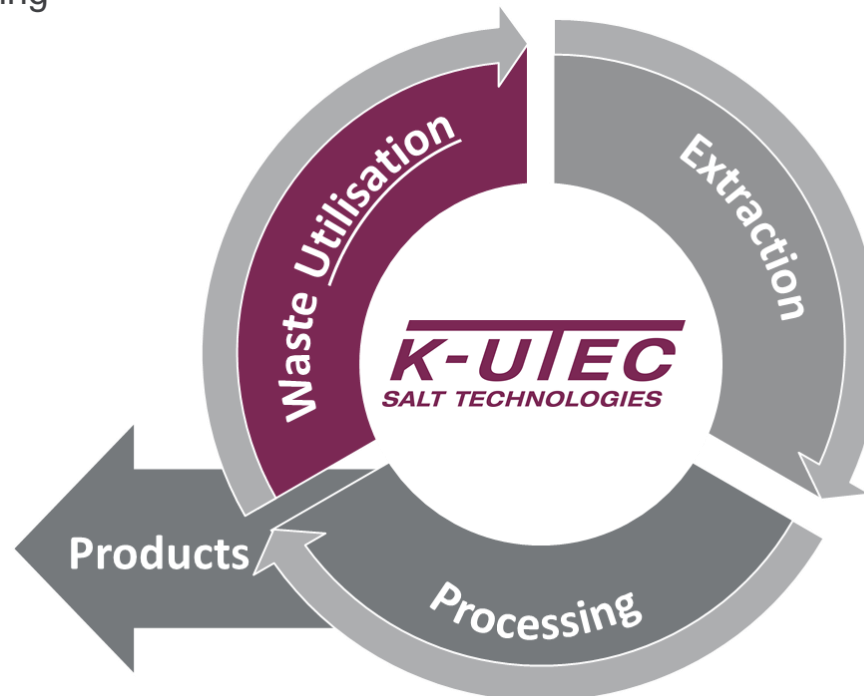
K-UTEC'S VISION ON SUSTAINABLE MINING

We strongly believe...

- Traditional mining value chain



- The K-UTEC Vision on Sustainable Mining



CHALLENGES OF THE GLOBAL MINING INDUSTRY

Why we developed this vision?

1. Safety performance: mine collapse, (uncontrolled) mine flooding and sinkhole formation
2. Ecological footprint: risk to water resources and risks related to surface subsidence
3. Resource efficiency: typical extraction ratio for underground mining below 50%



Akzo dragged into Spanish controversy about hazardous salt tips

Germany's K+S potash sales up in Q2, Werra legal battle continues



Source: Wikimedia Commons



Source: The Rising Tide Blogspot

A Dirty Business: The Inez Coal slurry spill; Massey Energy Spills and Spills Again



Source: Tagesschau

Deaths from a mudslide in Brazil



Source: Itar-Tass news agency

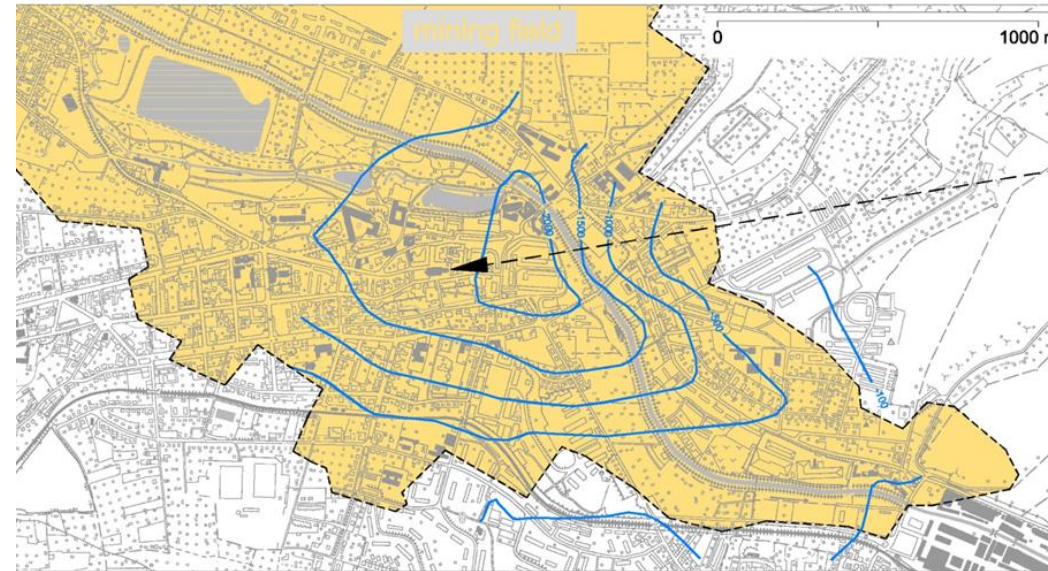


Sinkhole gets bigger in city plagued by giant craters

THE POTASH INDUSTRY AS INSPIRATION FOR OUR VISION

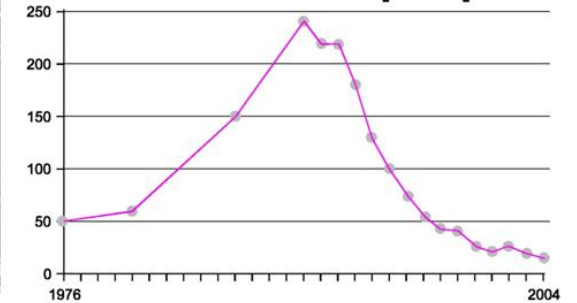
Managing stability and subsidence risks following the German reunification (1990)

- Potash mines in Central Germany encountering subsidence and seismic risk after German Reunification
- Initial stabilisation with NaCl
- Initially managed by the German State
- NaCl = €€€€ → industrial waste
- K-UTEC and SBN:
 - have stood at the cradle of the backfilling industry in Central Germany
 - are still heavily involved in the continuous improvement of the active operations
 - aim to revitalise the local potash industry, and
- **K-UTEC and SBN wish to communicate and disseminate this experience globally and to other parts of the mining industry**



situation at and below ground surface

ratio of surface subsidence [mm/a]



seismic events



until 1992



1997

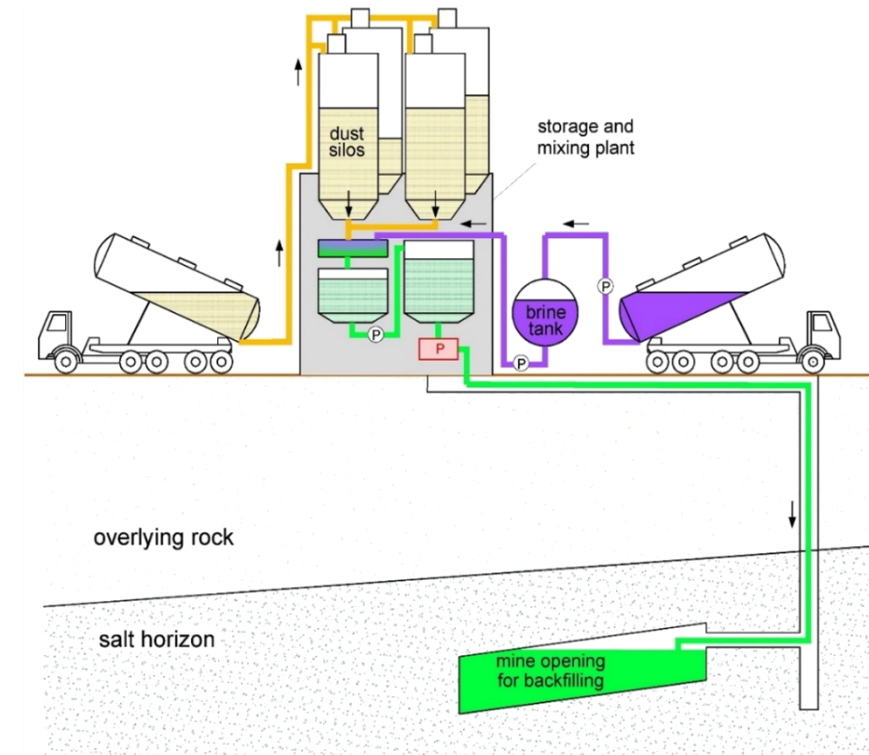
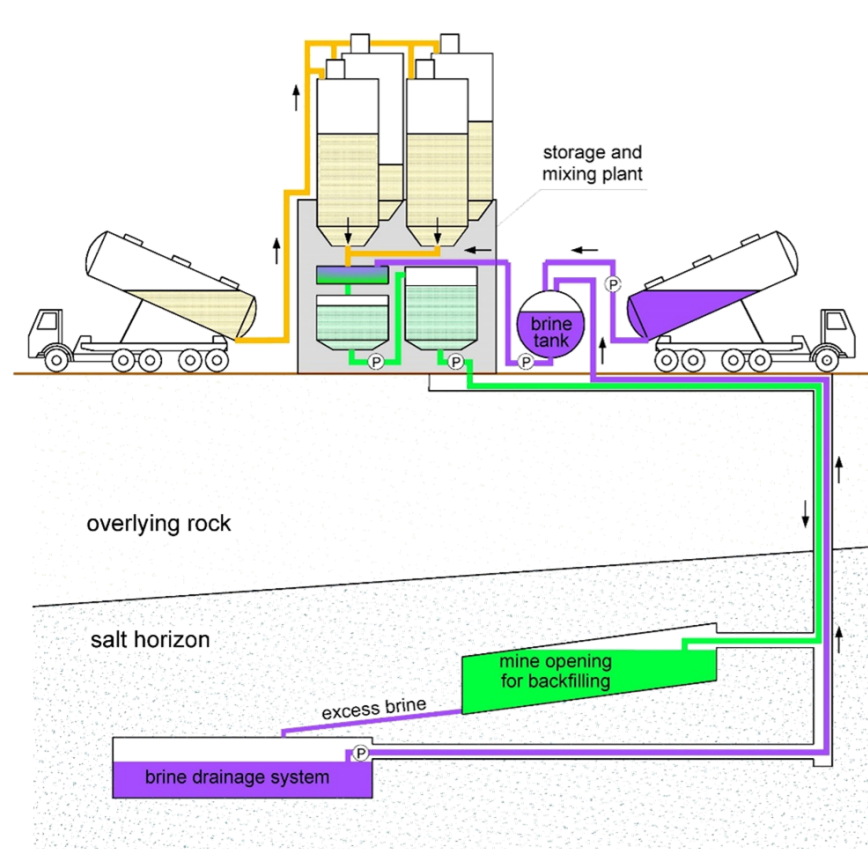


2004

UNDERGROUND BACKFILLING OF INDUSTRIAL, MINING AND PROCESSING WASTES

Advantages of mine backfill with industrial and mining wastes

- Safe & permanent solution for (hazardous) waste storage
- No burden on biosphere
- Minimises impact of mining on ground surface (subsidence)
- Minimises seismic impact of mining (rock-burst/earthquakes)



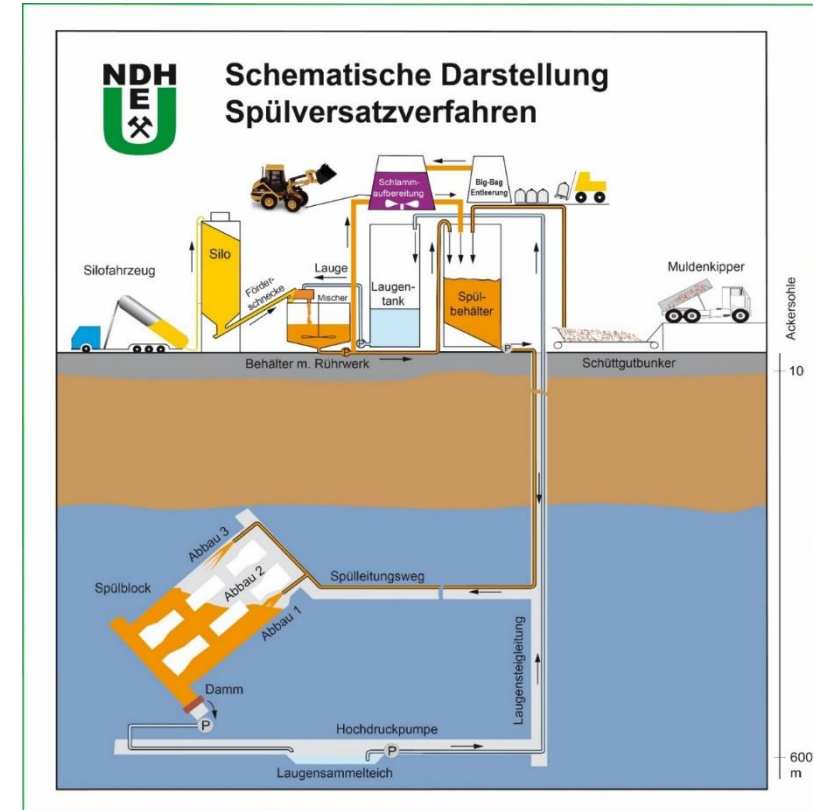
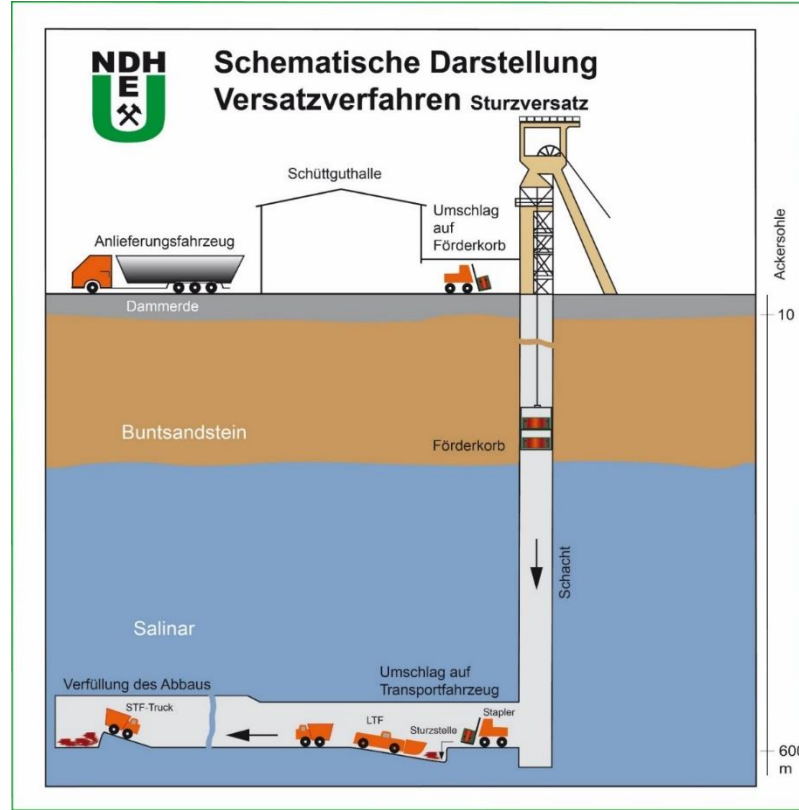
SCHACHTBAU NORDHAUSEN

Projects – Germany, Bleicherode

- NDHE LLC, subsidiary of SBN
- Backfilling by using diverse industry waste materials, recultivation of old heaps
- Backfill method: big bags, hydraulic backfill, bulk backfill
- Minimizing the heap place on the surface
- Preventing subsidence on surface by backfilling of underground cavities
- Economical and environmental advantage by reusing the underground cavities and removing the waste, which has a negative impact on the surface environment

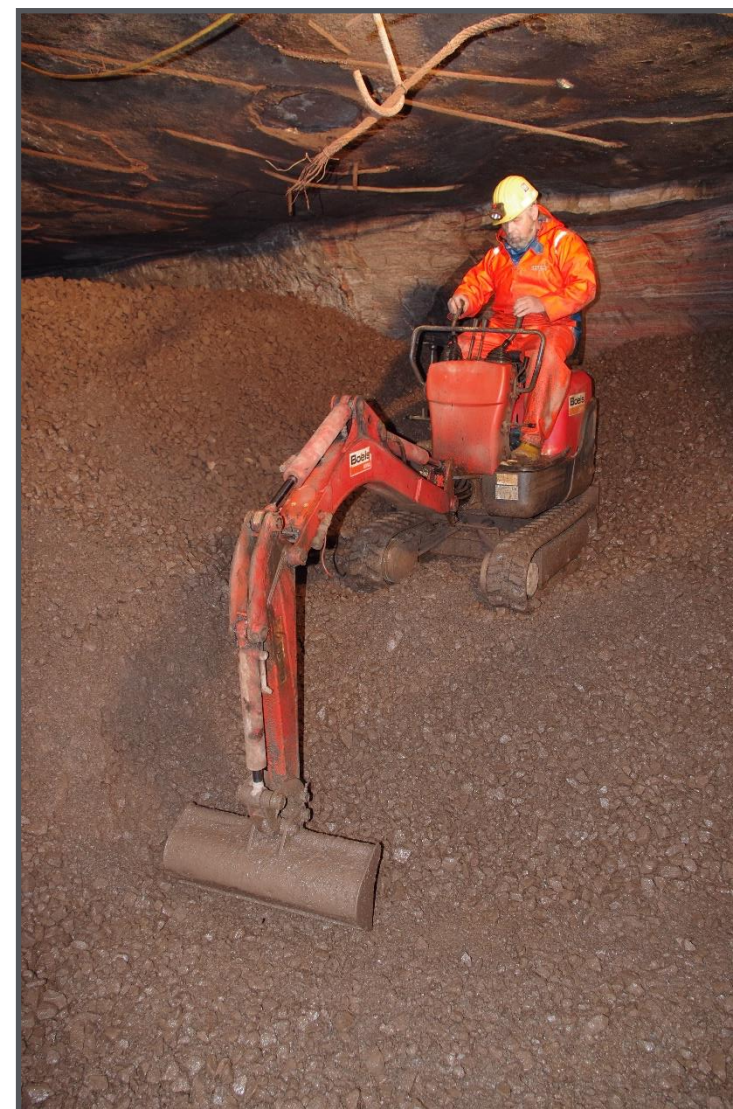


Projects – Germany, Bleicherode



SCHACHTBAU NORDHAUSEN

Projects – Germany, Bleicherode



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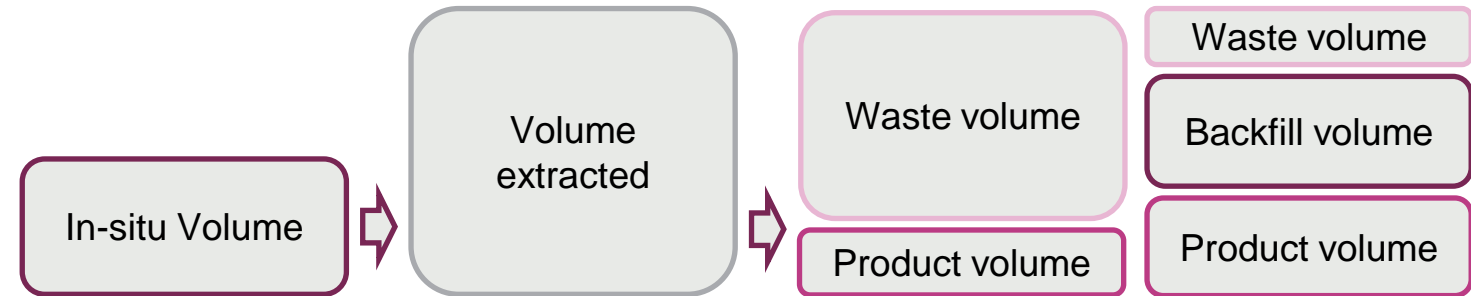
Projects – Germany, Bleicherode



THE BACKFILL TOOLBOX

Backfill composition criteria:

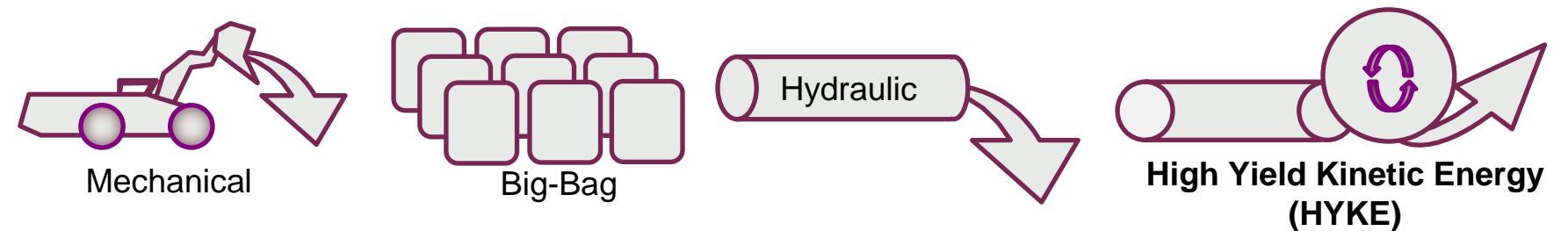
- Volume balance



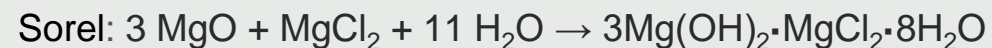
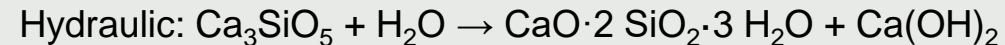
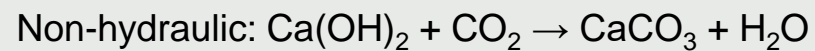
- Chemical and physical behaviour:



- Transport and deposition methods:



- Binder systems



THE ROAD TO SUSTAINABLE POTASH EXTRACTION AND PROCESSING

The central role backfill will have to play...

Hydraulic backfill

Current practice



HYKE backfill

High Yield Kinetic Energy backfill



HYPE

High Yield Potash Extraction



HYPERION

High Yield Potash Extraction Reducing Impact on Nature



HAVING A VISION IS REQUIREMENT FOR SUCCESS...
BUT SO ARE THE PEOPLE THAT CAN BUILD AND OPERATE IT!

SCHACHTBAU NORDHAUSEN

Projects – Germany, Shaft Konrad

- Old mine for low radioactive waste storage
- The project begun in 2011 and it will end in 2023
- Heading work for maintenance hall
- Maximum cross section: 120 m²
- Project value ca. 150 m€



SCHACHTBAU NORDHAUSEN

Projects – Germany, Shaft Konrad



SCHACHTBAU NORDHAUSEN

Projects – Germany, Sondershausen

- Construction of a new headframe
- Headframe: 38 m high and 250 t
- Headframe used for the backfilling transport
- Completely manufactured in our own workshop
- Project value ca. 5 m€



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Projects – Germany, Sondershausen

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HYPERION

1. Safety performance of underground potash extraction:

- Backfill → limit subsidence and eliminate sinkholes
- Automation → lower exposure to harsh conditions
- eliminate personal accidents

2. Lower the ecological footprint:

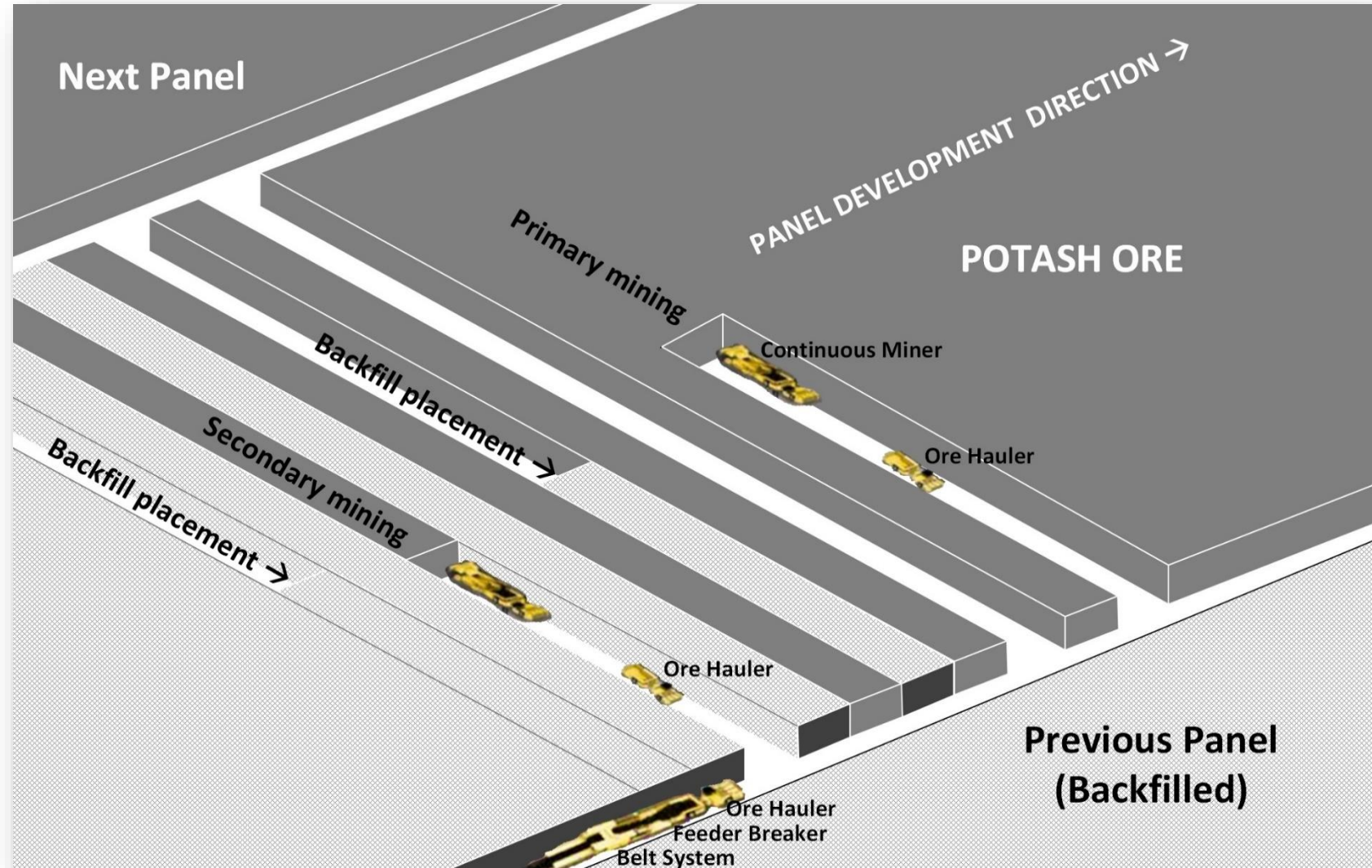
- Waste \triangleq backfill → no direct impact on water resources
- no hazardous eluates
- lower risk of catastrophic tailings dam failure / heap slope failure

3. Improve the resource efficiency:

- Backfill \triangleq pillar → near 100% extraction ratio
- Near 100% extraction → increase the Life-of-Mine
- lower investment and energy consumption per tonne extracted

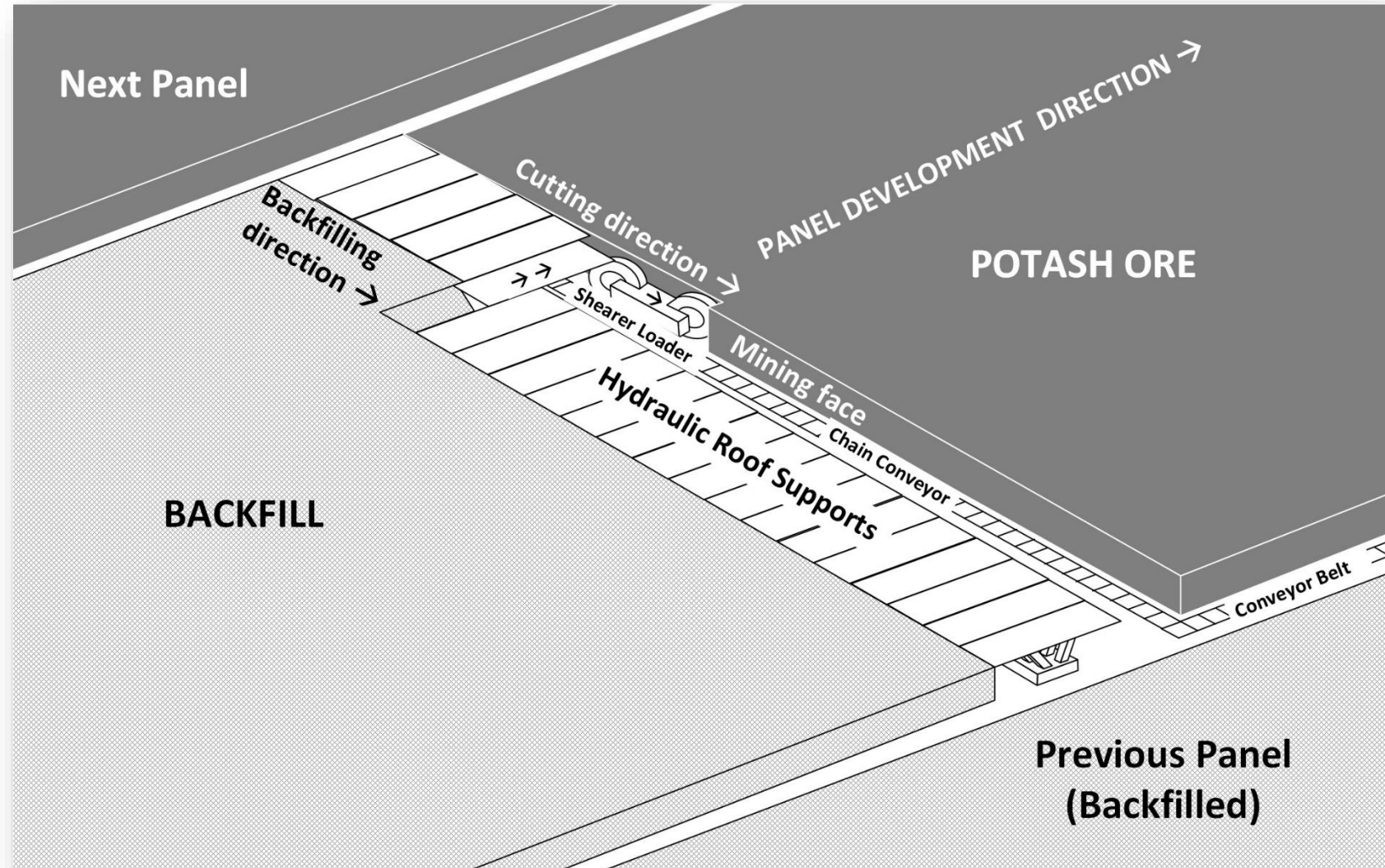
HIGH YIELD POTASH EXTRACTION REDUCING IMPACT ON NATURE

HYPERION



HIGH YIELD POTASH EXTRACTION REDUCING IMPACT ON NATURE

HYPERION





Thank you for your attention

Glück Auf!

and let's discuss...