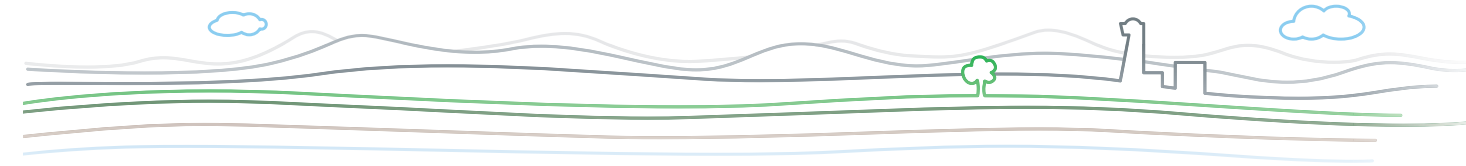


# Underground recovery



## What is the legal basis of the facility operation?

Recovery of waste is done in compliance with the Ordinance on the Use of Waste for Backfilling in Underground Mines. The necessity to backfill exists for decommissioned, localised areas within certain claims. Backfilling requires authorisation by the competent mining authorities. All of the K+S recovery facilities have been issued indefinitely valid mining-technical certificates.

All facilities function based on BAT ("best available techniques") and have been certified as qualified waste management facilities (EfbV). Additionally, we use a strict quality management system.

## What is necessary in order to reutilise waste?

Wastes and individual components are assessed separately. A chemical analysis and a declaration analysis of the wastes are required. On this foundation, two expert opinions are prepared. As soon as the material and geo-mechanic suitability and admissibility in accordance with the criteria of occupational health and safety regulations has been certified, the competent authority issues an approval for the respective recovery measure.

## What does K+S do in order to maintain the standards long-term?

Our own control system serves to inspect the composition of the wastes and to match the results of the analysis with the information provided in the declaration. This allows for a speedy reaction in the event of deviation.

All technical equipment which is directly related to the recovery process is regularly monitored. The results of these checks are documented and are regularly inspected by the relevant authorities.

## PACKING AND TRANSPORT

### The decisive factors are:

- The backfilling method
- The waste characteristics
- Local conditions at the mines

### Transport options:

- Tautliner truck
- Silo truck
- Tipping truck

### Packaging:

- Big bags

The majority of the waste does not require special packaging. Due to their powder form, they can be conveyed pneumatically and are delivered in bulk by silo truck.

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## TYPES OF WASTE (EXAMPLES)

- Fly ash
- Incinerated clearing sludge
- Contaminated soil and building materials
- Bypass dust / bymix dust
- Sand
- Salt

## WASTE RECOVERY CONDITIONS

Wastes must not be radioactive, highly flammable, explosive, liquid, contagious, malodorous or easily flammable under backfilling conditions.

Under backfilling conditions, reactions of the wastes with each other or the surrounding rock bed must not cause volume expansions, the generation of self-ignitable, toxic or explosive gases or substances, or any other dangerous reactions.

UNDERGROUND RECOVERY  
Technical information

## What is underground recovery?

Underground recovery uses the material characteristics of the deposited wastes in order to stabilise older, decommissioned mine segments. This so-called 'backfilling' may be necessary in certain clearly defined mine segments which no longer comply with today's strict standards. In this case, the mining authorities require backfilling.

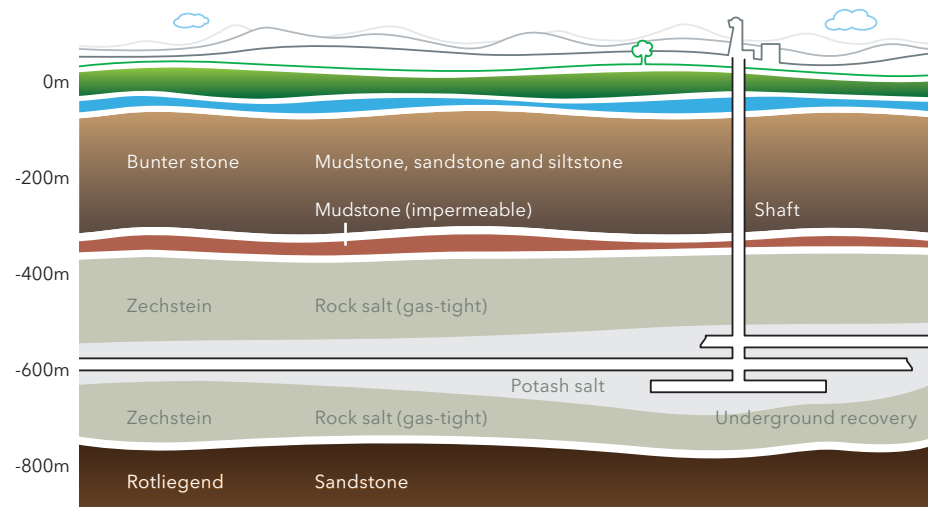
K+S employs three different recovery procedures:

- Stacking backfill
- Tipping backfill
- Slurry backfill

## Long-term safety | Geological situation

The geological conditions of the deposit site have been stable for millions of years, ensuring that the waste is securely sealed off from the biosphere. All of the K+S underground waste recovery facilities have been issued with proof of safety of permanent disposal.

### Schematic diagram of geological conditions



The recovery sites are located in the potash and rock salt layers.

### Properties of the rock salt:

- Formed 250m years ago due to the evaporation of seawater
- Thickness up to 500 metres
- Gas-tight
- Plastic reaction to forces moving the earth's crust; formation of open crevices not possible

## The recovery facilities

### Bernburg | Tipping backfill

Our partner AUREC processes wastes with low contaminant content above ground into a consistency structurally suitable for backfilling. The material is taken below ground via a drop shaft. Conveyor systems and dump trucks transport the material to the mining caverns, where they are deposited as tipping backfill. As a last step, the materials are compacted.

This transport system also allows waste packed in big bags to be brought below ground and deposited.

### Hattorf | Stacking backfill

At the Hattorf facility, pneumatically transportable wastes are trans-shipped into upright silos and are processed in a mixing plant using company-own formulations. After the wastes have been filled into big bags they are left to harden. Suitable wastes already delivered in big bags are taken directly to the site of deposit, or are discharged into a special plant, where they may undergo further treatment.

Big bags are stacked underground. Any remaining gaps are filled with moistened salt. This ensures direct connection with the pillars.

### Zielitz | Tipping backfill

Pneumatically transportable material is trans-shipped to above-ground upright silos, and is fed into plastic bags by a packaging machine. After these bags have been stacked in a transport container they are taken below ground, and the material is stacked at the backfilling location. The created surfaces are then covered with rock salt.

### Wintershall | Stacking backfill

Pneumatically transportable wastes are trans-shipped to upright silos and are then filled into big bags. The contents of the big bags are compacted mechanically on a vibrating plate. It is also possible to accept materials already packed in big bags, as long as these materials comply with the underground recovery requirements. These big bags are stacked below ground. Remaining gaps are then filled with moistened salt. This ensures direct connection with the pillars.

### Untereizbach | Slurry backfill

Pneumatically transportable material is initially trans-shipped to upright silos, and is then taken below ground via a closed pipe-work system. The addition of liquid (salt solution) results in a slurry, which can be pumped into the caverns. There the slurry hardens and sets, thereby supporting the rock salt layer.

