PACKAGING

All types of waste need to be packed in tightly sealed containers which have been approved for underground waste disposal. These packing units need to be able to withstand mechanical strain, comply with ADR regulations and withstand waste-induced corrosion.

Packaging is chosen based on the particular characteristics of the waste. Selection criteria are toxicity, pH values, residual moisture and the waste’s fine dust proportion.

Types of packaging:
- Big bags
- Steel drums
- Steel containers

At the Herfa-Neurode underground waste disposal plant, pneumatically conveyable waste in powder form can also be delivered in bulk by silo trucks; packaging in big bags is done on-site.

EXAMPLES OF TYPES OF WASTE

- Galvanic residues
- Hardening salt residues
- Arsenic, cyanide and mercury wastes
- Chemical distillation residues
- Filtration residues
- Contaminated soil and construction material
- Evaporation residues from landfill leachate
- Filter dusts
- Hazardous waste containing fibres
- Residues from the steel and metal industry

WASTE DISPOSAL CONDITIONS

Waste suitable for underground disposal must not be:
- Radioactive
- Explosive
- Highly flammable
- Liquid
- Contagious
- Metalloids
- Bioaccumulating
- Highly flammable under deposit conditions

Under deposit 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.

矿产工程

The potash deposits at the Zielitz and Herfa-Neurode locations were extracted using the ‘room and pillar’ system. A tessellated grid of pillars supports the rock overburden. The mining chambers remain open and accessible, while at the same time the structural safety and stability of the mine workings are maintained. Nevertheless, the deposit of waste does require preparatory work: gallery roofs are inspected and repaired wherever necessary; rock salt rubble is compacted to form level roads and utility space.
# The K+S underground disposal plants

Underground waste disposal plants in rock salt are considered to be the safest solution for the disposal of hazardous wastes. In underground disposal plants, waste is permanently removed from the biosphere without the need for any future processing.

The K+S Group operates two underground waste disposal plants.

## Natural barriers | Geological situation

The geological situation is decisive for the safety of the underground disposal plants. The geological conditions within the gas-tight rock salt have been stable for millions of years. The stored waste remains securely enclosed in the solid salt beds and is reliably withdrawn from the biosphere for good. The underground waste disposal plants are located in exhausted mines where excavation finished a number of years ago, at depths of up to 800 metres.

## Artificial barriers | Technical measures

1. **Packaging**
   
   All waste is packed in big bags, steel drums or steel containers.

2. **Stone walls**
   
   As soon as depositing in a chamber is complete, it is walled off against the other deposits either by a stone wall or a salt bank.

3. **Dampping up of deposit field**
   
   After a deposit field has been filled, all entrances are permanently sealed by massive dams.

4. **Shaft backfilling**
   
   After mining or deposit activities have ceased, all shafts – representing the only connections to the environment – are backfilled, making them secure for the long term.

5. **Properties of the rock salt:**
   
   - **Formation:** 250m years ago, by evaporating seawater
   - **Thickness:** up to 500 metres
   - **Gas-tight**
   - **Plastic reaction to forces moving the earth’s crust; formation of open crevices not possible**

## Disposal procedures

1. **Delivery**
   
   Delivery may be affected by tautiliner truck. In Herfa-Neurode we fill dusty waste delivered by silo truck on-site into big bags. In Zielitz waste can be delivered in sea containers as well.

2. **Inspection**
   
   Acceptance checks include an inspection of waste volume, packaging as well as the mandatory documents.

3. **Sampling**
   
   After an inspection for outgassing, the waste is subjected to a visual inspection. An identification analysis of a sample is done.

4. **Transport to the shaft**
   
   If the waste complies with the declaration, acceptance is completed and it is then transported to the shaft.

5. **Deposit**
   
   Waste is transported below ground through the shaft and is deposited in the intended storage site, in the exhausted and decommissioned mine sections. There the waste is stored in several tiers.

6. **Documentation**
   
   All waste is labelled with a code. A reference sample is taken from each delivery and is stored in a separate room below ground. Storage location and time are recorded in detail, and are entered into site maps and databases. The disposal site is actually comparable to a large warehouse.