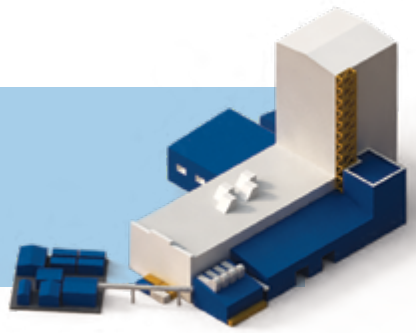
Production chain

Mining



NEW TECHNOLOGIES

Automation and improvement of production processes, including through the introduction of simulation modelling for underground mining planning at Polar Division, helps boost output in the real-time mode and reduce costs.

Stripping

Provides access from the surface to the deposit through underground workings used to transport mined ore, people, etc.

Development workings

The deposit is divided into separate sections, including mining levels, blocks, sublevels, stoops, etc.

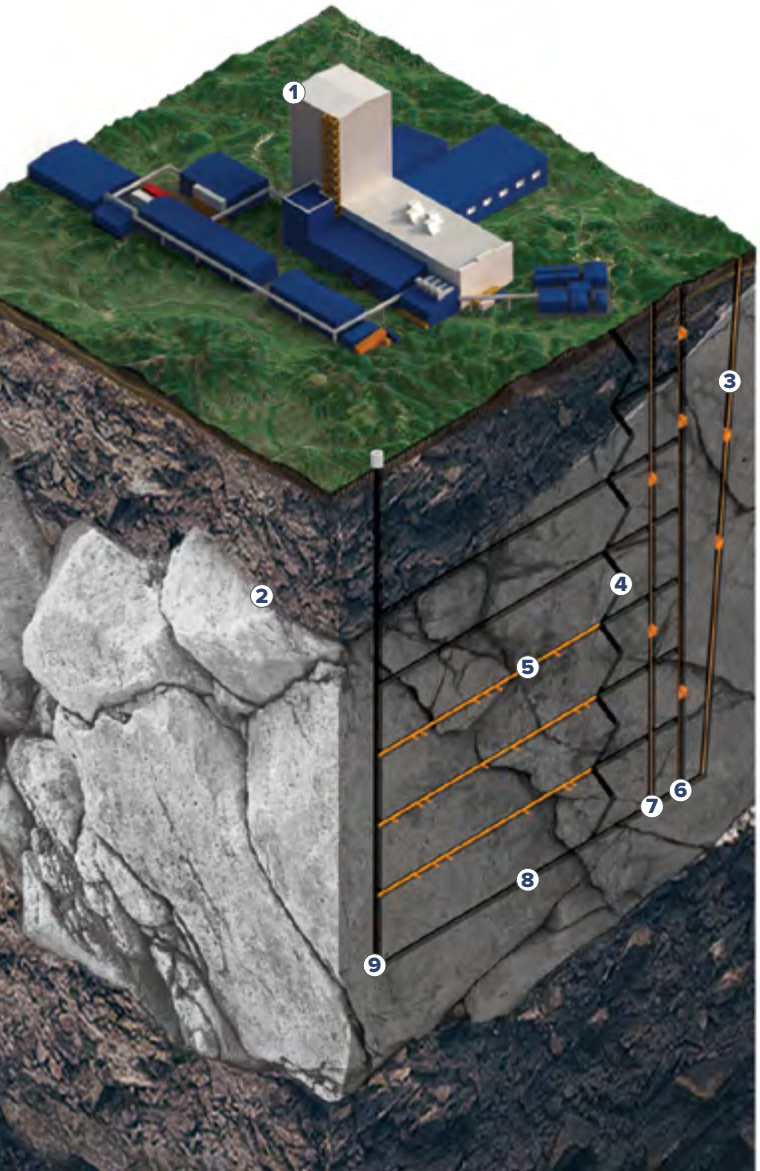
Stoping

- separation of ore from the rock;
- delivery of ore from the mine face to the haulage level;
- maintenance of the excavated area.

Rock mass removal

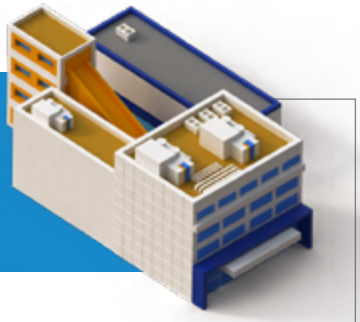
Ore is removed by load-haul dumpers and delivered to the surface by conveyor, railway and motor vehicles, or through skip shafts.

Ore to be transported to the concentrators



1. Mine
2. Ore body setting profile
3. Inclined shaft
4. Ramp
5. Crosscut
6. Skip shaft
7. Cage shaft
8. Haul roadway
9. Ventilation shaft

Concentration



Ore dressing

Crushing

Screening

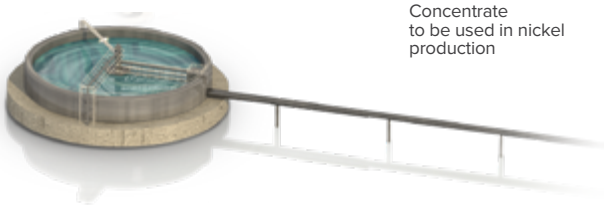
Sizing

Grinding

NEW TECHNOLOGIES

Briquetting of copper-nickel concentrate (mechanical pressing of feedstock with a binder material) replaced the obsolete pelletisation and roasting technology (using heat to remove significant portions of sulphur from the concentrate).
The introduction of the new feedstock preparation technology helped substantially reduce sulphur dioxide emissions (by 35 -40 ktpa at Polar Division alone).
As briquettes have a higher sulphur content than pellets, during conversion the smelting shop produces gases that are richer in sulphur dioxide and are therefore easier to capture and recycle.

Thickening

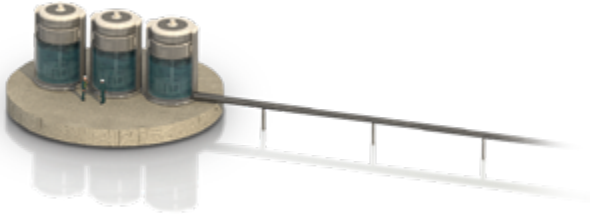


Cu
Concentrate to be used in copper production

Ni
Concentrate to be used in nickel production

Tailings to be transported to the tailing dump

Flotation



Production chain (continued)

Nickel production

Ni

NEW TECHNOLOGIES

Saline effluent disposal process at the tank house

Saline effluent is a by-product of nickel refining operations that has to be disposed of. In Monchegorsk, the process is designed in the form of a closed cycle. The steam and condensate resulting from evaporation are then reused in the tank-house to heat solutions and operate heat exchangers.

The treatment facility for saline effluents also ensured a more advanced treatment of industrial discharges, with chemical agents, specifically boric acid, flowing back to the production circuit. Now, instead of having to deal with harmful waste, the Company produces additional saleable goods - sodium sulphate and chloride. Those are widely used by the chemical industry (production of synthetic detergents) and utility companies (as de-icing agents).

State-of-the-art electrowinning technology

The technology has been piloted at Kola MMC and is to be rolled out across the Group. Removal of the anode electric arc furnace from the production chain will help reduce emissions. Nickel powder produced in tube furnaces is used as the feedstock. This technology is less labour-intensive (the cells no longer need to be taken offline and cleaned after each loading cycle thanks to the use of insoluble anodes) and ensures zero losses of both precious and non-ferrous metals. On top of that, the resulting metal has maximum purity.

Matte smelting

Flash smelter

Matte

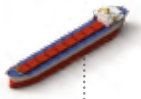
Conversion

Basic oxygen furnace

Preparation of high-grate matte

Casting mould

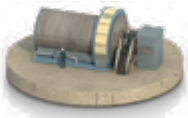
Cu, Ni
High-grade matte to Kola MMC



Preparation of high-grate matte

Casting mould

Grinding



Separation of high-grade matte

Flotation

Nickel melt

Nickel concentrate

Anode electric furnace

Anode smelting

Fruid-bed furnace

Copper concentrate to Copper shop

Casting wheel

Electrolysis

Electrolysis baths

Nickel cathodes for sale

Pt, Pd, Au, Ag
Slime to be used in precious metals production

Nickel slame to Polar Division

Production chain (continued)

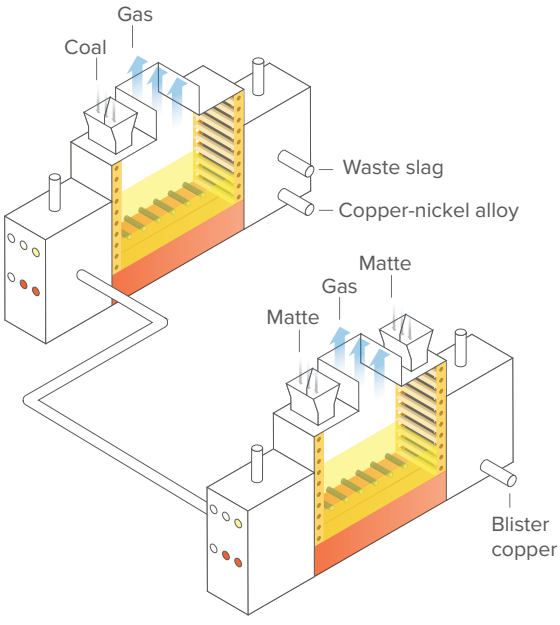
Copper production

Cu

NEW TECHNOLOGIES

Continuous converting technology

The technology is being rolled out at NMP's continuous copper matte converting facility (as part of two Vanyukov furnaces – the basic oxygen and slag cleaning ones) to improve its blister copper production cycle. The new process uses a cutting-edge technology to dispose of smelting gases, with sulphur being taken into a continuous stream of highly concentrated gases ready for disposal.



This technology will help reduce sulphur-rich gas emissions by at least

30%

Concentrate

Thickening

Filtration

Concentrate drying

Smelting of matte

Kola MMC

Polar Division

Copper matte

Reverberatory furnace

Copper matte

Slug to dump

Vanyukov furnace

Electrolysis

Electrolysis baths

Copper anodes

Copper slame to Polar Division

Casting wheel

Pt, Pd, Au, Ag

Slime to be used in precious metals production

Conversion

Basic oxygen furnace

Anode electric furnace

Anode smelting

Nickel slag to Nadezhda Metallurgical Plant for nickel production

End product

Copper cathodes for sale

Blister copper

Polar Division