



# SIKA AT WORK

## CHUQUICAMATA UNDERGROUND MINE, CHILE

MINING: Sika® ViscoCrete® Sika® Plastocrete®

BUILDING TRUST



# CHUQUICAMATA UNDERGROUND MINE

GOING DEEP FOR COPPER

Underground Chuquicamata is a strategic mining project for Codelco, the state owned Chilean copper mining company. The project includes the transition of the large open-pit mine, which is in operation for 90 years, to an underground mining operation. This will allow exploitation of the copper resource well below the current pit outline.

## PROJECT DESCRIPTION

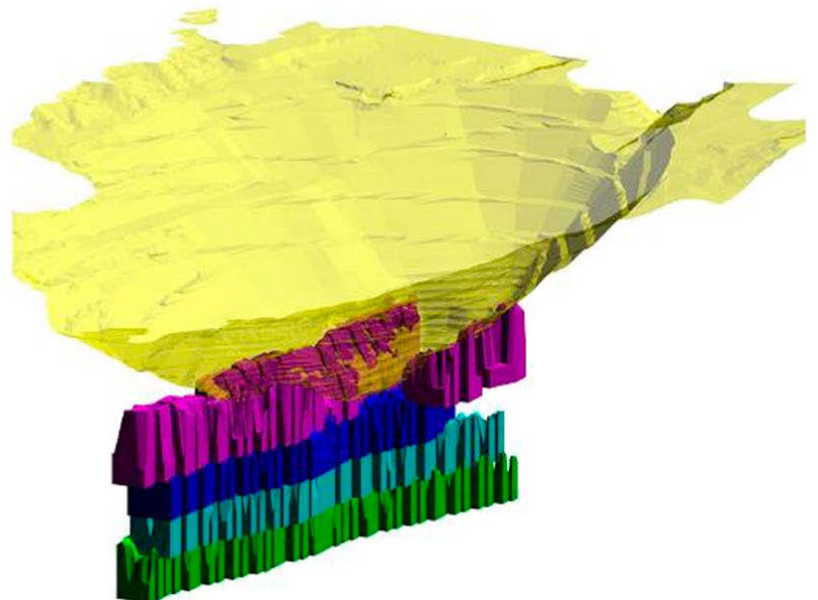
Around 1.700 million tons of copper and molybdenum ore have been identified under the open-pit that extends the life of mine for 40 years.

The ore will be extracted through an extensive “block caving” operation, by installing four production levels. 140.000 tons of ore will be mined and treated per day, making Chuquicamata one of the largest mining operations on the globe with an estimated investment of more than US\$ 4.2 Billion by 2019. The total underground development contemplates no less than 100 kilometers of tunnel development until 2019 by when the project should reach design capacity. The development phase will be followed by at least 10 years of ongoing underground development to keep the production rate at planned levels. Sika has a clear vision to become the lead provider of concrete solutions and other consumables in this long term project.



## PROJECT REQUIREMENTS

The Chuquicamata underground expansion will be implemented, using conventional drill and blast drifting. Due to the nature of the orebody, the geological conditions and the strength requirements for the underground support, demanding fortification systems for the infrastructure below the caving ore body apply. Shotcreted steel frames and ribs are used as supporting elements where secondary support must be of exceptionally high dimensioning. Fiber reinforced shotcrete and a dense pattern of yielding bolts are used throughout the extraction drives, drifts, ramps and undercuts. In addition to the development of the tunnel infrastructure, up to 900 meter deep shafts, ore passes and ventilation raises are being built. Such structures are very demanding in terms of the volume and requirements of concrete and shotcrete which makes the Chuquicamata underground project a challenge from a technical as well as a logistical point of view.



## Mining in the Atacama Desert

Due to its remote location, more than 1.500 kilometers away from the capital of Chile in one of the driest deserts of the world, mine suppliers and contractors have to deal with a very harsh climatic environment more than 2000 meters above sea level. Sika serves Chuquicamata from the Sika supply hub in Antofagasta with extensive storage capacity on site.



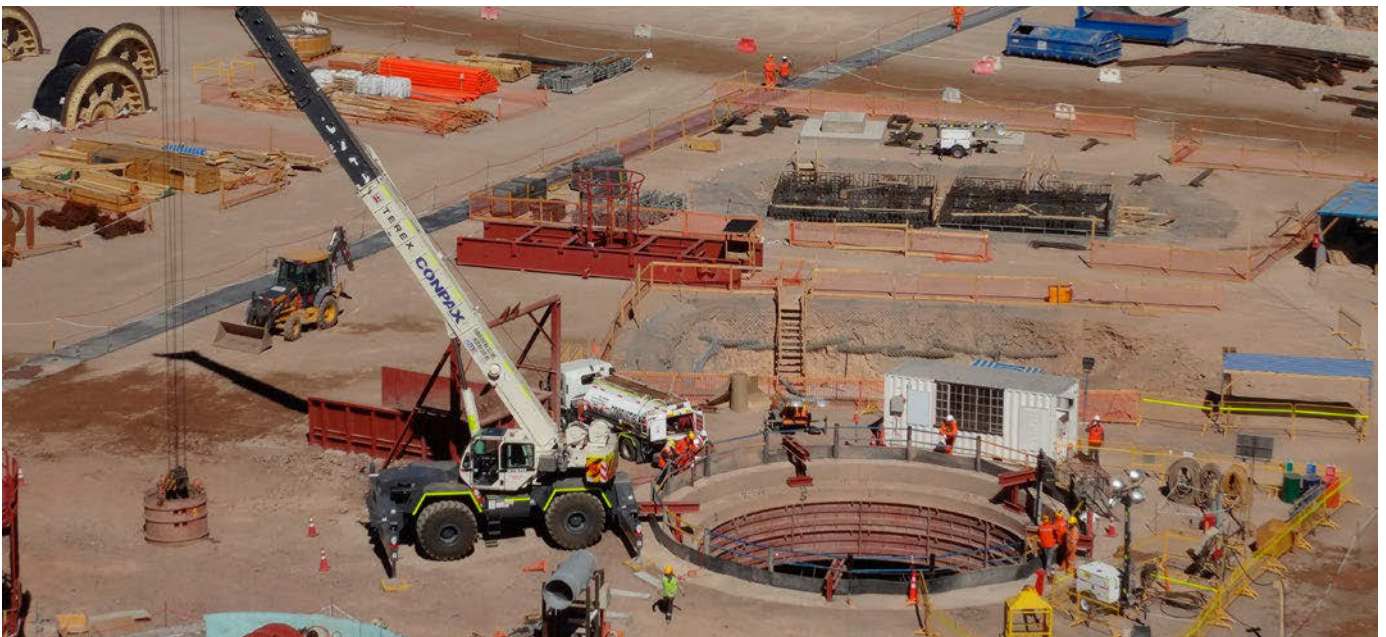
### SIKA SOLUTIONS

Sika is contracting a large volume of the concrete business at Chuquicamata, providing a range of products and support for wet-mix shotcrete, fibers, conventional concrete, self-compacting concrete and products for the maintenance of the large ore treatment facility on site. For every developed meter, around 170 kilos of Sika admixtures are used. The alkali-free accelerator represents the largest off-take by volume, making up to 85% of the total demand. Main efforts are currently guided towards the implementation of Viscocrete, Plastocrete, alkali-free accelerators technology for concrete lining and shotcrete mix-designs in combination with fibers of different types. Pre-dosed cementitious grouts for the extensive cable bolting represents another part of the business. It is also expected that Sika will be able to provide other technologies in the future to offer an integrated product mix for the underground development at Chuquicamata.

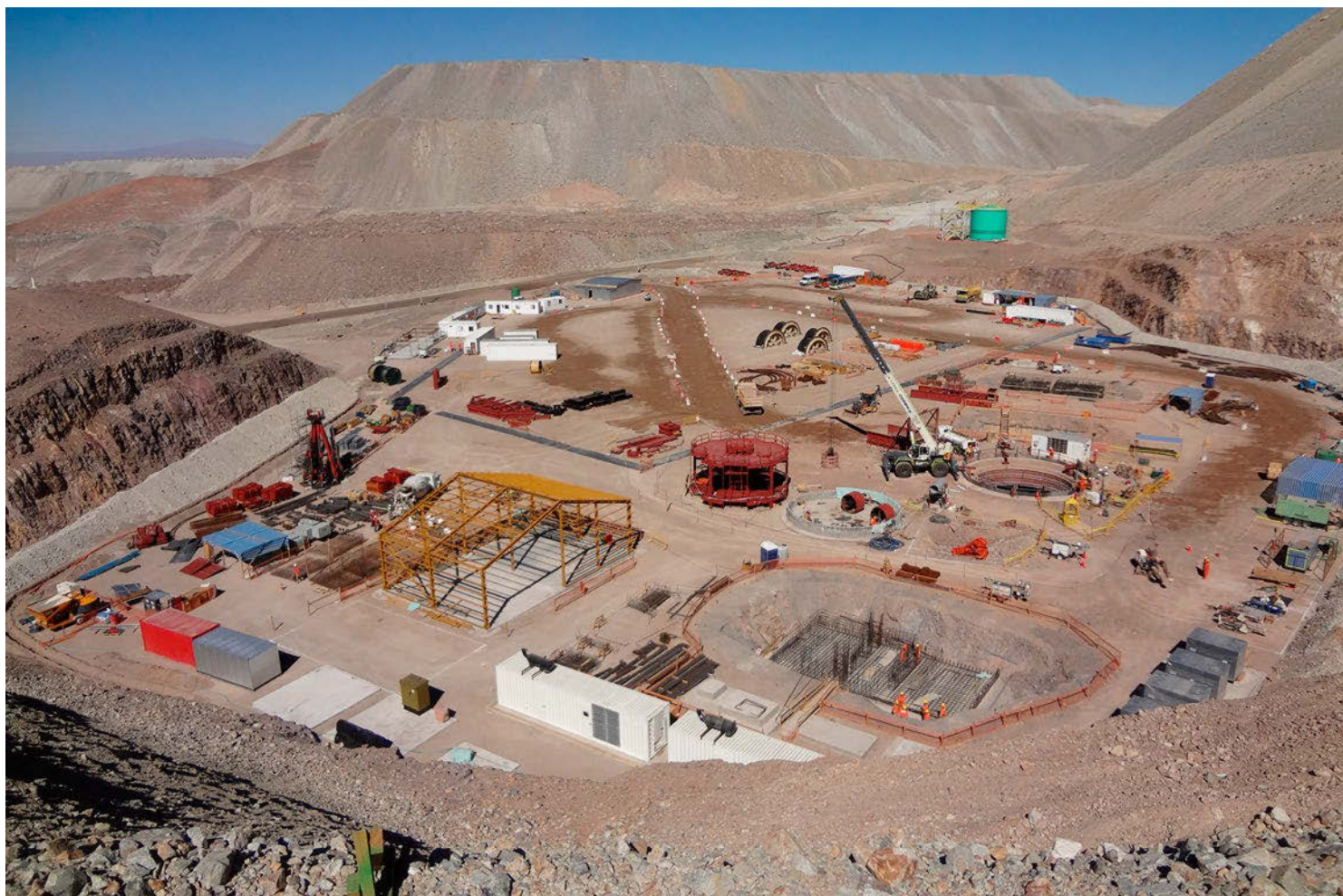


### Success factors

Sika Chile has been awarded with 70% of the total concrete admixture business technologies for the underground infrastructure due to the well established presence in Chile and the technological know-how in this field. Another important contribution for the success of the project is the efficient supply chain from the Sika Antofagasta Plant, located in La Negra sector in northern Chile that delivers all required admixtures to Chuquicamata. Codelco and its main contractors consider Sika as a reliable and innovative partner for the development of this unique project, where constant on-site support and laboratory resources are provided.



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## PROJECT PARTICIPANTS

Ventilation tunnels: Contract under development with Acciona Ossa Consortium

Transport and haulage tunnels: Contract with Astaldi Construction.

Extraction level infrastructure OIM: Contract development with Astaldi Construction.

Ventilation raises: Contract under development by the consortium formed by the companies Aveng Grinaker from South Africa and the Chilean Mas Errázuriz.

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**SIKA SERVICES AG**  
Tüffenwies 16  
CH-8048 Zürich  
Switzerland

**Contact**  
Phone +41 58 436 40 40  
Fax +41 58 436 41 50  
[www.sika.com](http://www.sika.com)

