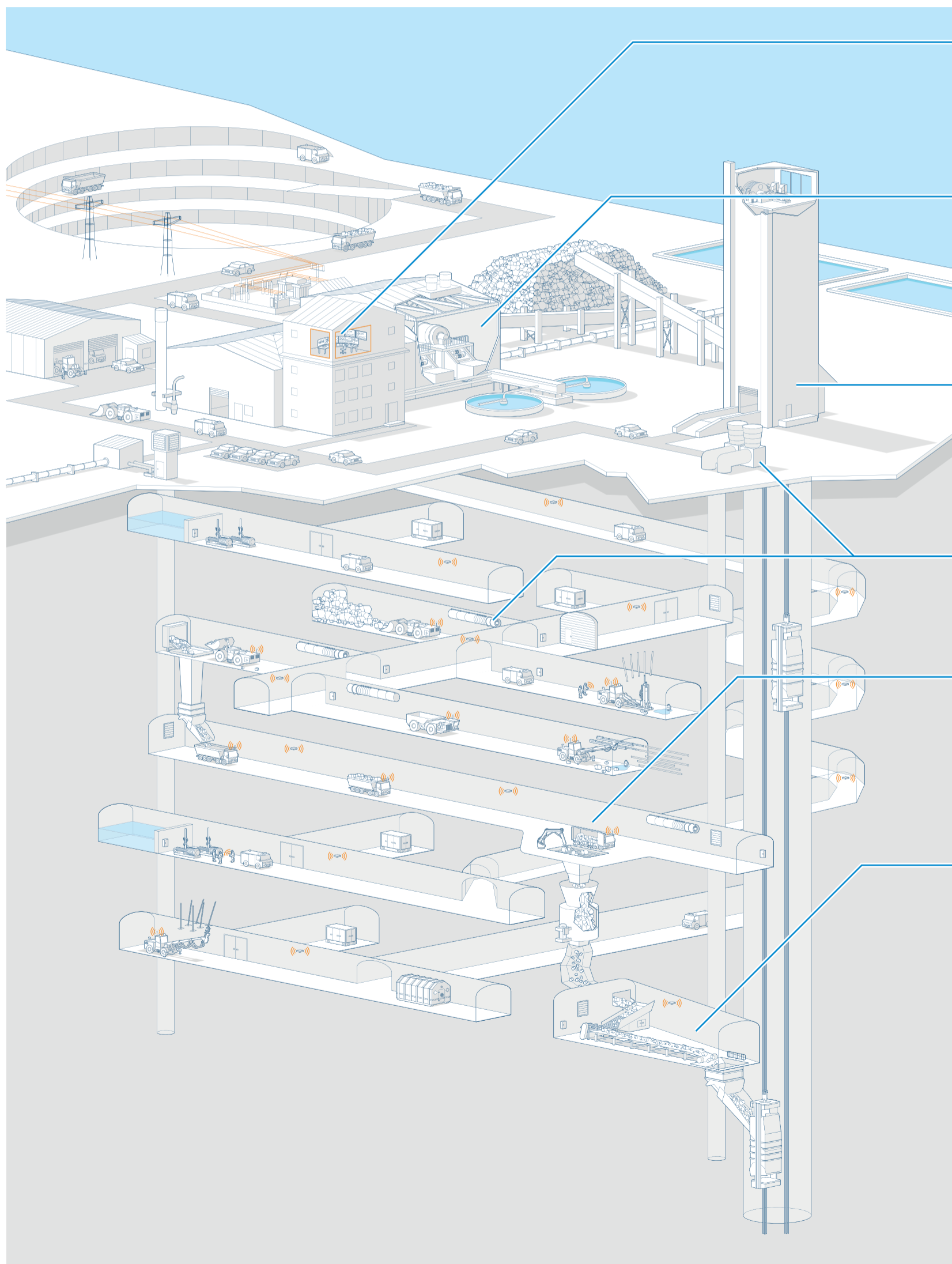


Next Level mining in action

Mine tour – overview



Control room

Automation solutions help Garpenberg to be one of the most cost-effective and modern mines in the world. ABB's System 800xA controls almost all plant equipment and systems to automate the production and administration.

Concentration process

Concentration is done in two steps – flotation and dewatering. Three mineral concentrates are produced: zinc, lead and copper. ABB has delivered its proven advanced process control solution to optimize zinc flotation in order to achieve better zinc recovery at given grade.

Mine hoists

Mine hoists can best be compared to elevators; they are purpose built to lift ore, people and equipment throughout a mine safely and efficiently. ABB has delivered a complete mine hoist solution for both the production hoist and the service hoist.

Ventilation

ABB's SmartVentilation solution provides a controlled ventilation that delivers fresh air where and when it is needed.

Crushing station

There are two underground crushing plants where the ore is crushed in jaw crushers. ABB has delivered a large number of motors and drives for the crushing stations, all integrated to the control system 800xA for best possible overview, better control and safe production.

Skip loading station

After crushing, the ore is transported via conveyor belt to be hoisted to the surface by the production hoist. ABB has delivered mechanical equipment, such as skip support and fixed guides at the loading and dumping stations. The ore is weighed at a weighing station, before loading, with highest precision in order to avoid under- or overload to the skip for highest productivity.

Next Level mining in action

Station overview – Garpenberg mine

Ventilation system



With ABB's SmartVentilation solution, ABB provides a controlled ventilation system that delivers fresh air where and when it is needed. At the same time, it minimizes the use of energy through the utilization of on-demand functionality, which yields 30 – 50 % savings compared to normal installed power. The system also improves the safety conditions through built in functionality in case of fire such as preventing spread of smoke and enabling faster exhaust of hazardous fire gases.

ABB has delivered a SmartVentilation solution to Boliden's Garpenberg mine. The first installation was in 2009 with some 70 fans. A system upgrade and expansion was done in 2013 due to production increase in the mine from 1.5 MT to 2.5 MT per annum. Today, the system supervises and controls all 120 fans, gates and air quality sensors used for mine ventilation.

The system controls everything from providing the fresh air, heating, distribution inside the mine, and exhausting used air from the mine.

Mine hoist systems



Mine hoists can best be compared to elevators; they are purpose built to lift ore, people and equipment throughout a mine safely and efficiently.

ABB has delivered a complete mine hoist solution for both the production hoist and the service hoist. Both hoist control systems are fully integrated into the mine control system, which means that both mine hoists can be operated and supervised from a single mine control room above ground.

Production hoist

A production hoist delivers ore from the bottom of the mine to the surface. A production hoist is normally operated in "automatic" mode, which means that it is automatically filled by a conveyor belt underground and then emptied by the dumping curves in the head frame.

Production hoists are designed to ensure an optimum, automatic flow of ore from underground to surface. There are a number of safety features built into mine hoist systems, including a redundant supervised control system to ensure the safe operation of the hoist such as emergency brakes, rope slippages, speed control, etc.

The ABB scope of works covers both mechanical and electrical equipment in the system.

Service hoist

The service hoist is used for the transportation of people and small equipment from surface to underground and the other way around, much like an elevator in a building. Transportation can be done in a few minutes instead of more than 30 minutes by road vehicle.

Like the production hoist, the service hoist has embedded several safety features to ensure safe operation and transportation of personnel fulfilling strict regulation defined by the Swedish mining authorities (BRAGS).

The ABB scope of work covers both mechanical and electrical equipment in the system.

Comminution and concentration process



Comminution has two primary processes: Crushing and grinding. Crushing is carried out on 'run-of-the-mine' ore, followed by grinding. The grinding process is done in two steps and results in a slurry containing water and finely ground ore. After particle size reduction in comminution, the ore is concentrated and valuable minerals are separated from the waste rock during the concentration process.

Mill drive systems are a critical component in ore and mineral processing. ABB supplied two ring-gear mill drive systems for the grinding mills. The variable-speed solution is maintenance friendly and allows for optimized operation. In addition, ABB also provided drive systems for flotation cells, pumps and thickeners as well as the overall plant control system (800xA).

Concentration is done in two steps – flotation and dewatering. The flotation process is a surface-chemical process, where small amounts of chemicals are used to affect the valuable minerals' surface characteristics, causing them to become hydrophobic. This means that when air is blown into the slurry, air bubbles are attached to the surface of the hydrophobic

mineral particles and are transported up to the surface of the flotation cell, where they can be removed. Then the mineral concentrates are dewatered using thickeners and air pressure filters. Three mineral concentrates are produced: zinc, lead and copper concentrates.

Process control in grinding and flotation

Advanced process control (APC) in grinding and flotation is a must to maximize plant output and reduce chemical reagent use as well as to prevent costly unplanned plant stops by respecting the operating range of plant.

ABB and Boliden have a long track record of successful collaboration in the field of automation technology. In 2009, ABB and Boliden agreed to collaborate on a project to achieve a successful application of Model Predictive Control (MPC) to a complete flotation circuit. The aims were twofold; firstly to stabilize the process in spite of external disturbances, such as ore quality changes. Secondly, the zinc revenue should be maximized, through zinc recovery and concentrate grade.

ABB has delivered its proven advanced process control solution to optimize the zinc flotation process in order to achieve better zinc recovery at given grade. The solution provides 1% higher yield and more consistent zinc quality.

Control room



Equipment in a mine must be controlled and monitored in a coordinated manner whether they are distributed above or underground throughout the mine. Automation solutions from ABB helps Boliden Garpenberg to be one of the most cost-effective and modern mines in the world. ABB's System 800xA controls almost all plant equipment and systems to automate the production and administration. Garpenberg is the first mine with integrated mine hoists, mine ventilation and monitoring of vehicles in an underground mine.

System 800xA controls water supply system, crushers, belt conveyors, concentrator, harmonic filter system, press filters, pumps and pumping stations, mine ventilation, skip loading, hoisting as well as electrification.

There are many autonomous systems for different purposes in Garpenberg. Almost all of them are integrated into System 800xA. By taking production in focus and based on the process control system 800xA, an integrated control system and unified operator environment drives production efficiency to a high level while lowering the costs.

Underground



The Garpenberg mine is an underground mine where the ore is mined from between 500 to more than 1,200 metres below ground level. The main mining method is known as sublevel stoping. This means that the ore is mined in layers between two drifts (tunnels), which are driven through the ore body. There are two underground crushing plants where the ore is crushed in jaw crushers. The crushing plants are situated 700 meters, and 1,087 meters below ground level. After crushing, the ore is transported via conveyor belt to be hoisted to the surface by the production mine hoist, the one you also will see above ground in the head frame.

We will travel down into the mine via the service hoist to a depth of more than 1000 meters in order to take a better view of the crushing station at 1,087 meters deep and also to the bottom of the production mine hoist at 1,150 meters deep where the skip is filled.

ABB has delivered a large number of motors and drives for feeders, conveyor belts, for the crushing stations and also for the dewatering system, all integrated to the control system 800xA for best possible overview, better control and safe production. For the skip loading station, ABB has delivered mechanical equipment, such as skip support and fixed guides at the loading and dumping stations. The ore is weighed at a weighing station, before loading, with highest precision in order to avoid under- or overload to the skip for highest productivity.

The underground mine electrification is also delivered by ABB and controlled by System 800xA. The rock breakers, machines for crushing big rocks, are remotely controlled by ABB's remote control stations, ensuring safe operations and improved productivity.