

Codelco's RFID system, from MiningTAG, brings visibility into the amount and quality of ore being extracted at the world's largest underground mine, to ensure the safety of the tunnels and manage the kind of ore being extracted for customers.

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Tags: [Operations](#), [Visibility](#), [Mining](#)

Apr 16, 2018—Monitoring operations and production at the world's largest underground mine is a monumental task. Chilean mining company [Codelco](#) is employing radio frequency identification technology to accomplish this task at its El Teniente (Spanish for "The Lieutenant") site. The project won this year's [RFID Journal Award](#) at [RFID Journal LIVE! 2018](#), held last week in Orlando, Fla.

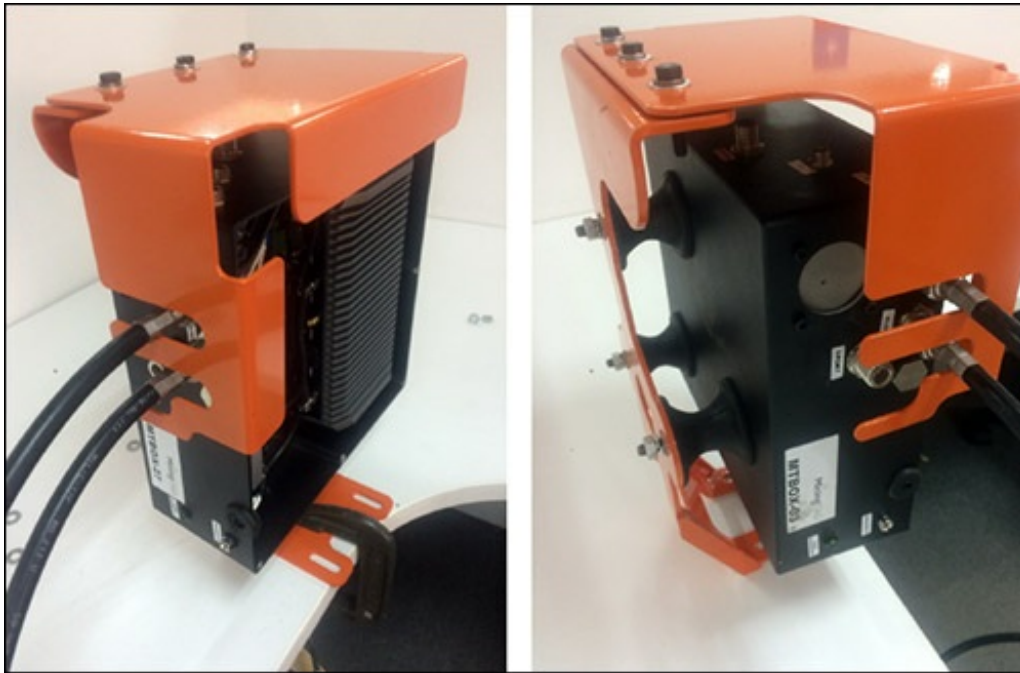
The system consists of RFID readers on vehicles; tags at hundreds of sites within six mineshafts in Codelco's El Teniente division in Rancagua, Chile; and software to manage the collected data, all provided by [MiningTAG](#). The system is known as MTOneMine. With the technology, Codelco is able to confirm where ore is being mined, as well as how fast this occurs, and thereby ensure the integrity and safety of the mine shafts. It can also understand productivity and ensure the highest quality of ore being processed.



MT Onemine allows companies, using RFID technology and other types of sensors, to control the production of critical equipment in underground mining.

El Teniente is an underground copper mine in the Andes mountain range. The mine employs 19,000 direct-hire and contract workers. The extraction of copper ore from the mine shafts must be carefully controlled for several reasons. First and foremost is safety, as the removal of too much ore in one specific area, for instance, could create a weak spot that could collapse while miners are underground.

A highly publicized 2010 mine collapse at a neighboring site—in which 33 workers were trapped for 69 days—led to greater concerns for safety across all of the nation's mines, explains Andrés Rodríguez, MiningTAG's general manager and CEO. At that time, Rodríguez cofounded MiningTAG as a system to provide worker safety in mines.



The M/T Box

In addition to safety concerns, there are economic issues to consider. The mines need to collect the best mix of ore, and to charge for that ore according to quality. However, equipment operators are often incentivized to collect ore from the most convenient locations, in order to increase their own number of cycles. That can mean extracting from an unexpected location that might not provide the best ore for the batch being collected.

Codelco had already deployed a MineTAG solution to track the movements of its workers. The system employs RFID readers and tags from [Identec Solutions](#), which are managed via MiningTAG's Watcher Personnel software platform. The tags are worn by workers and placed on vehicles, while readers installed within the shafts capture tag IDs and forward that data to the mine's software via a Wi-Fi connection.

More recently, Codelco began working with MineTAG for another use case of the technology—monitoring the movements of its ore-extracting tools, such as shovels and dump trucks—in order to identify where ore is being removed, as well as when and how quickly. Tracking ore extraction is not only a safety issue, but also an economic one. The quality of the ore and the amount of dilution necessary depends on where that ore is taken; it must be carefully planned to keep production efficient.



An RFID reader installed in a vehicle

Prior to deploying RFID technology, Codelco tracked ore extraction manually using paper and pen or a passive RFID system that, according to the company, was not sufficiently reliable. The firm assigned extraction points to each operator, but then had to trust that the operations were conducted as instructed. The new ore-extraction tracking system thus needed to provide real-time production indicators online, Rodriguez says, so that the firm could manage shifts better, share information between management and operators, and optimize production in an integrated way.

Because the company requires very specific location data throughout the lengthy mine shafts, MiningTAG deployed a system that is configured in the opposite way of the worker safety system. In this latest installation, readers are attached to the extraction vehicles, with tags placed at hundreds of locations down the mine shafts.

MiningTAG and Codelco started with a pilot in 2017 on a limited section of the mine, in which only 10 percent of the equipment fleet of shovels and trucks operated. "The objective of this pilot," Rodriguez states, "was to find the weaknesses of the system before implementing it throughout the whole fleet."

Identec UHF readers with two antennas were installed inside the vehicles, while active Identec sensor tags with built-in batteries were attached to the walls along the mine shaft. The readers are built into an M/T Box, an integrated metal box developed and fabricated by Mining TAG with an Identec reader, a [Laird S9026XR](#) RFID antenna, a built-in [Advantech Trek](#) computer, inductive sensors, a Wi-Fi adapter and a 7-inch screen display.

Based on the pilot results, MiningTAG then improved the mounting supports on the equipment to sustain the high vibrations of the shovels and trucks. The company also made modifications in the software, Rodriguez notes, so as to improve read rates from 75 percent to 96 percent.



The on-board computer can access an operator's tasks for the day, which it displays on his or her screen.

The system begins tracking a vehicle's movement once an operator climbs aboard. The driver presents his or her RFID-enabled badge to the vehicle reader, after which the ID is captured and the software confirms the authenticity of the badge and the driver, then allows that person to start the ignition. The on-board computer can access that operator's tasks for the day, which it displays on his or her screen. The driver can then proceed to the first assigned point, where the reader captures the tag at that site and the shovel operator can begin collecting ore.

The shovel next deposits the ore in trucks that are also assigned to that site, and the readers on those vehicles capture location data, providing a real-time view into which vehicles are dwelling at which locations, thereby indicating where ore is being extracted and loaded. Each truck then proceeds to the rail area, where it dumps the ore to be collected by trains. There, too, an active RFID tag is mounted, which beacons its own ID number to the reader aboard the vehicle.

When the vehicle reader captures the dumping area tag ID, that data is also transmitted to the system via Wi-Fi, after which management can view where the ore has been deposited. At any point throughout the process, if a vehicle operator is about to make a mistake—such as collecting ore from the wrong location—an alert is displayed on the onboard screen to prevent that error from occurring.

Following the pilot's conclusion, the readers were installed on 50 mining shovels and 15 mining trucks. In addition, MiningTAG installed more than 1,000 active tags at all loading points where the ore is extracted, as well as at dumping points. The project took 14 months to complete, the company reports.

To date, the system has been implemented at six of Codeco's eight sites. Since the solution was taken live, the mine reports that it has attained better control of the dilution of ore produced on a daily basis, which has increased the grade and thus the copper's economic value. Most important, however, is safety, the mine indicates. Greater control of the extraction process helps to guarantee the stability of the mining infrastructure, Rodriguez explains, thereby reducing extraction risks and assuring a longer life of the mine.



A Wi-Fi adapter in mining equipment

In addition, the technology can be used for analytics purposes, in order to improve productivity. Having indicators of production in an integrated manner, Rodriguez says, allows for improved management and more efficient operations. These benefits could potentially increase the company's production by 1 to 2 percent, MiningTAG predicts, which is equivalent to \$30 million to \$60 million per year.

"In addition, the implementation of the MTOneMine system allows the operators of mining equipment to have more production time," Rodriguez states, "as they no longer must write down the information." The work is safer and more pleasant for operators, he adds, since they now can dedicate their time to work rather than to filling out forms.