



Blasting vibration monitoring, Division Ministro Hales mine, Calama, Chile



Case study

October 2024

Introduction

The Division Ministro Hales (called also DHM) is a copper mine based in the North of Chile, close to the city of Calama. It is managed by Codelco and it is active since 2010.

In November 2021 a substantial rockfall occurred, devastating a crucial section of the mine's constructed slopes, as visible in the right part of Figure 1. This event caused a notable disruption in site operations, leading to considerable financial losses. Despite the effectiveness of various onsite surveys in predicting the collapse and facilitating the rescue of personnel and equipment, the mine management opted to enhance monitoring measures. This proactive decision involved the installation of five fixed and permanent vibration monitoring stations strategically positioned in the mine's most critical areas to bolster surveillance efforts.

The instruments chosen for the monitoring are the MR3003BLA devices manufactured by Syscom Instruments (<https://www.syscom.ch/>), able to measure both the velocity (in three directions) and the air pressure.

The installation and the management is done by Datageo and Geoblast, being part of the GB group (<https://geoblast.cl/>).

KEY FACTS

Name:	Division Ministro Hales (DMH)
Country:	Chile
Location:	10 km North from Calama (Chile)
Operating company:	CODELCO
Operative from:	2010
Type:	Open-pit mine
Extraction:	Copper
Yearly production:	181.704 ton3 of copper (2021)



Image 1: MR3003BLA monitoring system



Figure 1. View of the DMH open pit mine with the big collapse in the right part.



Figure 2. View from one of the vibration monitoring stations.

Monitoring configuration

To maximize minable area and productivity, the mine strives to construct slopes as steep as possible. However, this approach increases the risk of collapses, necessitating the installation of various monitoring stations. Positioned strategically within the DMH mine's critical zones, these vibration monitoring stations serve to detect any vibrations that may signal an imminent collapse. In Figure 2 a location very close to the vertical slopes is shown.

As can be seen in Figure 3, a monitoring station is composed by different elements:

1. A solar panel 50 W
2. A cabinet, including:
 - the MR3003BLA recorder
 - a battery 12 V, 12 Ah
 - a voltage regulator for the solar panel
3. The microphone, for air pressure monitoring
4. The external triaxial geophone, for velocity monitoring

While the microphone is installed directly on the rod, pointing towards the blasting zone, the vibration sensor is placed on the ground. To have a good coupling, the sensor is installed on a concrete pad that was previously injected in the ground.

All MR3003BLA have internet connection by means of the internal 4G modem and a SIM card with data subscription. As soon as data are recorded, they are immediately transferred to the dedicated FTP/SFTP server of Geoblast.



Figure 3. Monitoring station.

Results

Data recorded by MR3003BLA devices are analyzed with a specific post-processing software.

The main analyses done on the data acquired during the blasting activities are:

- Comparison to the America RI8507 norm, defining maximum vibration levels on site
- Evaluation of the PPV (Peak Particle Velocities) respect to the distance from blasting and to the amount of explosive charge
- Evaluation of the evolution in time of velocity and air pressure values

In case of standard threshold exceedance or any abnormal data trends, the site managers are promptly notified. Subsequently, upon analyzing information obtained from various monitoring sources, they can make informed decisions regarding onsite operations and safety measures.

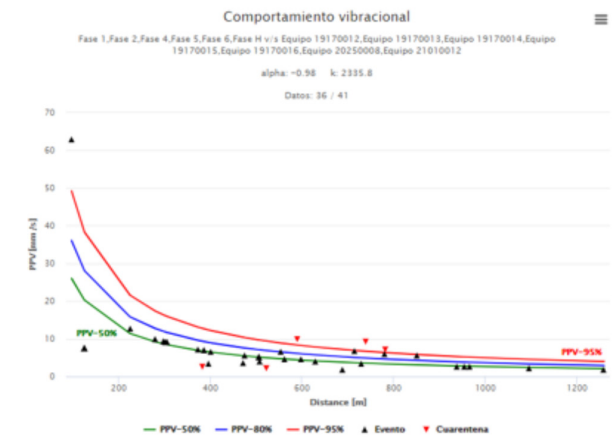


Figure 4. Analysis of vibration data.

Conclusion

The vibration monitoring inside the mines plays a crucial role in enhancing safety, optimizing equipment performance, and minimizing the environmental impact of mining operations, ultimately contributing to the sustainable and efficient management of mining resources.

MR3003BLA units allow continuously recording vibration and air pressure data in the most critical zones of the DMH mine, and transfer them automatically to a specific analysis software, which is able to process the data and give an evaluation of the risk of potential collapses in the different zones of the mine.

Special thanks to our Chilean partner Datageo for allowing us to do this case study.

<https://datageo.cl/>



About Syscom

SYSCOM Instruments is part of Orica Digital Solutions platform of trusted monitoring technology brands. Orica Digital Solutions is the industry's first, end-to-end sensor to cloud data delivery platform that supports proactive, risk-informed decision making and monitoring. SYSCOM Instruments SA is a leading supplier of vibration and seismic monitoring equipment for the civil engineering and safety markets, in particular for nuclear power plants and LNG plants. The reputation of SYSCOM Instruments SA is based on the reliability of its products, resulting from a meticulous control of all aspects of design and production.

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