

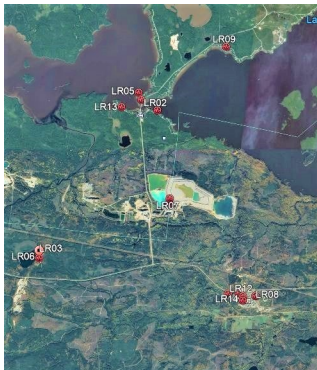
Vibration Monitoring, LaRonde Mine



Installation SVi minimate pro accelerometer



SVi minimate pro accelerometer



Aerial view of instrument location



Aerial view of LaRonde Mine, owned by Agnico Eagle Mines | Abitibi-Témiscamingue

The LaRonde mine is the flagship mine of Agnico Eagle Mines (AEM). Located in northwestern Quebec in the Abitibi-Témiscamingue region, the mine has produced nearly six million ounces of gold since it began operations in 1988. The mine's Penna shaft is 2.2 kilometres deep and is the deepest single-lift shaft in the western hemisphere.

The complex operations carried out in this very deep mine can generate significant ground vibrations felt in the surrounding villages. Since 2017, GKM Consultants has been providing the LaRonde mine with a fully automated seismograph network that facilitates the monitoring of seismic events in the surrounding villages. Since the development of this system, they have been able to react quickly and anticipate citizens' concerns when an event is detected.

GKM installed accelerometers and geophones to cover a radius of about 7 km. The equipment is located mainly in residences. The installed systems take continuous measurements and transfer data via cellular modems to GKM's secure servers. The acquisition systems can also generate alarms by e-mail in real time when established thresholds are exceeded, allowing mine managers to react quickly.

GKM assists AEM in obtaining a detailed understanding of seismic event behaviour by working closely with them to

produce specialized reports. AEM transmits to GKM seismic events that have exceeded a magnitude of 1.5 on the Richter scale. These events are then correlated to the level of vibrations recorded by the seismographs, which record the velocity of the seismic wave in mm/s. The maximum wave level in mm/s over a given period of time (PPV) is used as an indicator.

When a vibration level exceeds the threshold, a high-frequency signal acquisition is triggered. A frequency analysis is then performed on this signal to determine the dominant frequency (D_f) of the seismic wave. The PPV and D_f for each geophone axis are compared to the USBM recommendations and presented as a compliance table for each measuring station.

Over several years, GKM has developed solid expertise with respect to real-time monitoring applications accessible on the Internet. The data management system can be installed and configured directly on a customer's server or simply hosted at the GKM Consultants' Data Centre for remote access.

GKM Consultants reiterates its commitment to contributing to this project by implementing measures aimed at preventing damage to residences, structures and adjacent infrastructure.