

Autonomous Sensors

Monitoring tailings dams and spoil dumps

Challenge

Mine tailing facilities contain the waste material removed during the mining process, whereas spoil managements house the remains after the processing and removal of precious materials.

Where spoil contains only overburden or waste rock, due to the techniques used throughout the extraction process, tailings are usually a slurry of fine particles and may include but are not limited to rock, sand, chemical reagents and processed water. Spoil is commonly stored as a conical piles, whilst tailings are typically sorted in dams. The unravelling and ultimate collapse of either can result catastrophic consequences including injury and loss of life, significant impact to communities, and extensive damage to the environment.

It's understood that the geotechnical integrity can be irretrievably weakened by processes hard to identify, including abnormal pore pressures induced by ground water permeating and eroding the embankment or foundations of these structures.

The current process to monitor and assess these storage facilities for signs of failure rely heavily on visual inspections conducted by workers walking along the unstable perimeter and Piezometer-like devices with imperfect measurement capabilities. There is currently limited research surrounding the precursors or indicators to provide early detection of a failing wall. Therefore, no real monitoring process can provide an accurate assessment of real-time dam or spoil dump stability.

With the recent significant failures, a better way to monitor and maintain tailing storage facilities is required to improve safety and asset monitoring, and avoid environmental catastrophe.



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Research

The main objective of this project is to develop a wireless sensor solution that will determine the groundwater pressure and flow throughout a spoil dump or tailings dam. This solution will monitor the condition of the structure in order to reduce personnel, environmental and financial risks.

Phase 1 of the project focusses on the research, design and development of a prototype wireless groundwater pressure sensor that will provide information for determining stability. Many of these wireless sensors will be used together to profile groundwater conditions throughout the spoil dump or tailings dam. An optimal method of communication will be identified to form an interconnected mesh network that transmits data from each of the sensors through the spoil dump, to the surface and back to the engineer.

The collected data will then be analysed to develop a profile of the groundwater in spoil, providing much-needed insight into the causes and precursors to tailings dam and spoil dump failures.

Partners



Benefits

- Removal of personnel from hazardous areas including unstable grounds
- Active and remote monitoring of spoil dumps or tailings dams, allowing frequent safety audits
- Improved tailings dams and spoil dump designs
- Creation of mitigation strategies for groundwater pressure and seepage during and post mining activities
- Reduced cost of sensor installation and equipment

Status

Phase 1 of the project (now complete) contained three major areas of research and development.

1. Research and development of the Magnetic Pulse (MP) communication method, similar to the cave tracking method, but with higher data transfer rates and Tx/Rx capability in the one module.
2. Determining the type of sensors to be deployed to gather the correct physical data.
3. Research and development of the system required to operate the sensor network to gather data.

Phase 2 is expected to focus on the development and design of a working prototype. Mining3 is currently looking for partners for phase 2.

For more information contact:

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About Mining3

Mining3 is the world's leading research organisation, directed by its global mining industry members to develop and deliver transformational technology to improve productivity, sustainability and safety.

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