

Mine tailing dam failure

Industrial-scale mine waste storage dams are collapsing more frequently severely affecting communities and ecosystems.

To meet the challenges of the energy transition, the ore deposits exploited are less and less rich and mine become increasingly wasteful as technology allows the profitable extraction of much lower grades of ore.

These larger amounts of waste, called tailings, are frequently being stored in facilities that were initially designed for far smaller quantities of waste. Without an appropriate management, dams can fail under the volume of waste, causing considerable human, environmental and financial damage.

List of the major tailing dam failures [🔗 \(Chronology of major tailings dam failures\)](#)

In Brazil, 27 dam failures were reported between 2011 and 2018. On 25 January 2019, in Minas Gerais State, in the city of Brumadinho, the mining company Vale's dam failed catastrophically, which led to more than 200 deaths.

On September 11, 2022, the tailing dam of a diamond mine in South Africa failed. The mud wave (up to 1.5 km wide) travelled 8.5 km. It destroyed 51 houses and affecting another 103, sweeping away cars, disrupting power lines, killing two persons, injuring another 76, and displacing more than 300. At least 500 animals have died. The mud then entered Wolwas Dam, then Prosespruit, a tributary to Rietrivier, which flows into Kalkfontein Dam, located in a Nature Reserve.



Las Tortolas Tailing Dam, Central Chile.

Most dams are built with soil and tailings from the operating mine. This material has the advantage of being available on site, which reduces costs. However, its non-homogeneous nature favors water infiltration which slowly but inevitably leads to the weakening of the structure. The main failure cause is abnormal seepage, which can progress to an internal erosion process. To assess the stability and safety of dams, periodic inspections are carried out, which typically include visual inspections and geotechnical instrumentation. But do you know that Electrical Resistivity Tomography (ERT), a non-invasive and rapid method, is able to assist conventional geotechnical instrumentation?

[Moreira et al. 2022](#) [🔗 \(Application of electrical resistivity tomography \(ERT\) in uranium mining earth dam | Journal of Geophysics and Engineering | Oxford Academic\)](#) recently demonstrated satisfactory results concerning this geophysical technique.

ERT is able to detect the variation of the moisture content inside the dam body that accompanies the abnormal seepage. Seepage produces a decrease of the electrical resistivity.

SYSCAL PRO SWITCH (48, 72, 96 or 120)

The internal memory allows to store about 45 000 data points. It measures the electrical resistivity, chargeability and spontaneous polarization (SP). Electrical resistivity and spontaneous polarization could be relevant for dam investigation and monitoring.

A SYSCAL Monitoring module allows to use the SYSCAL for monitoring. With the Syscal Monitoring Unit, the user can change the time of acquisition, upload a sequence to the Syscal Pro from the office, download the data and choose to receive alerts (low Tx battery, too much erroneous measurements, problem to download the data) on a custom email address... It will program the automatic uploading of the acquired data on a FTP or SSH server or by email on a custom email address.

[SMU](#) [🔗 \(Syscal Monitoring Unit\)](#)

ICOLD 2023 dedicate a program on Tailings dams.