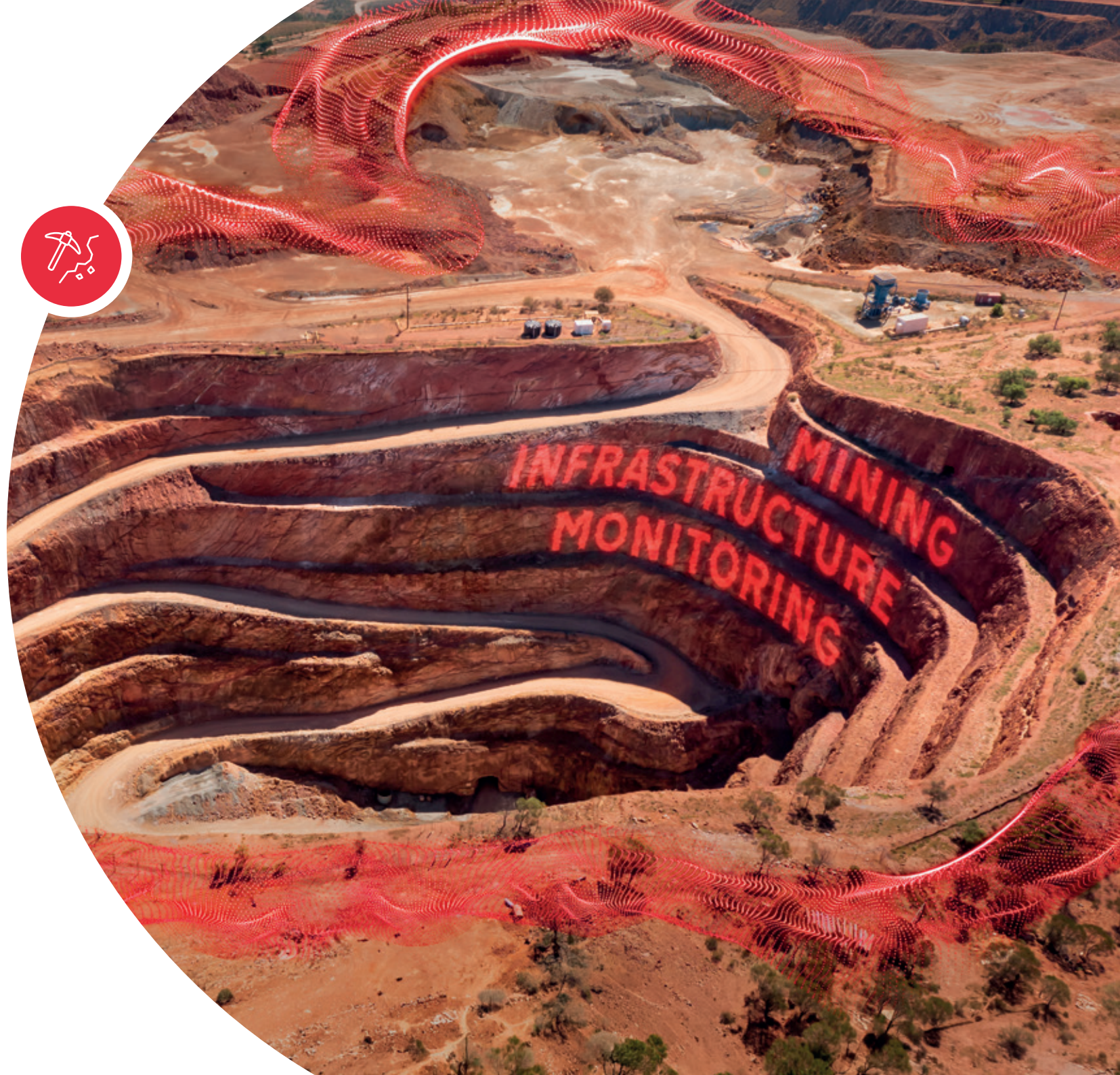




DISTRIBUTED FIBER OPTIC SENSING

for Critical Mining
Infrastructure



Long-Time Experts

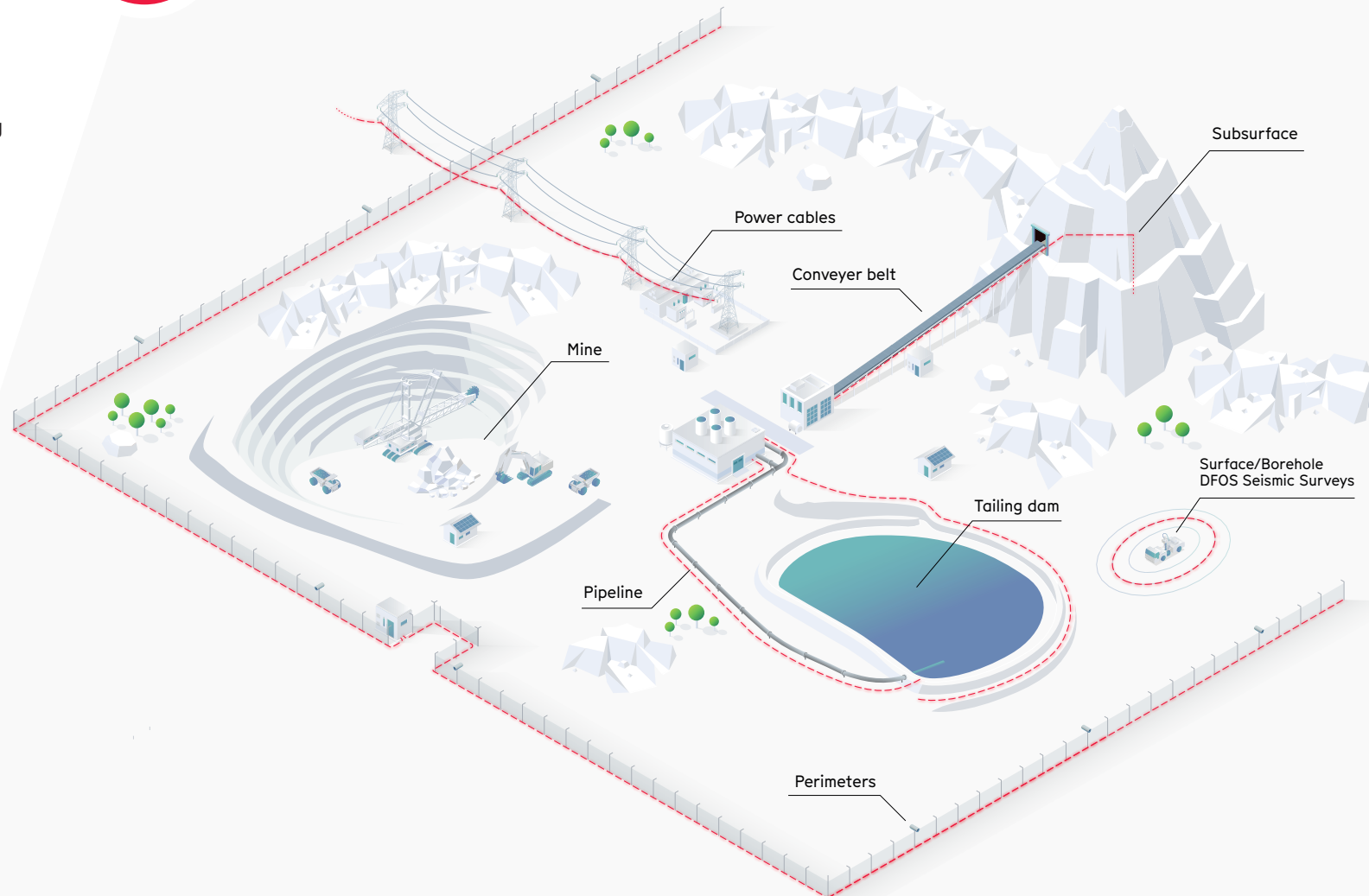
for Mining Infrastructure Monitoring



Distributed Fiber Optic Sensing (DFOS) is transforming mining infrastructure monitoring by delivering continuous, real-time insight across vast and hard-to-reach areas.

AP Sensing DFOS solutions support both preventive and predictive maintenance across multiple mining assets, enabling earlier detection of issues and more efficient planning.

Unlike traditional point sensors, DFOS converts fiber optic cables into continuous sensing networks measuring temperature, acoustic, and strain. This enables early detection of fires, leaks, ground movement, temperature anomalies, equipment faults, and potential structural instabilities, as well as seismic activity.



Distributed Temperature Sensing (DTS/LHD)

DTS provides benefits such as:

- 24/7 real-time asset monitoring, delivering thousands of measurement points of temperature data
- Large coverage over several kilometers with only a single, inert and dielectric fiber optic cable
- Early detection of hotspots, fires or temperature abnormalities indicating faults or other issues
- Highly reliable systems with a +35 year MTBF
- Freely configurable alarm parameter sets and zones enabling pre- and main alarms
- Greater equipment reliability
- Improved cost effectiveness
- Immune to EMI/RFI and dust, dirt and corrosion
- 3D location mapping and location accuracy down to one meter
- Operates in temperatures up to 750 °C for two hours according to IEC 60331-25
- Industry's most complete set of tests and certifications (EN 54-22 (VdS), UL521/ULC-S530, FM, DNV, KFI, SIL2, IECEx, ATEX)



Distributed Acoustic Sensing (DAS)

DAS provides benefits such as:

- Turns fiber routes into a continuous acoustic sensor with thousands of sensing points
- Powered by 3P Vector Technology, phase-based dual-channel DAS with full 2 x 100 km reach
- AI-driven event classification delivering high detection probability
- Designed for critical infrastructure compliance
- Built on AP.TrustedCore with an integrity-focused OS for tamper-resistant and compliance-ready operation
- Enables non-intrusive deployment with no active field components and seamless integration into security infrastructure
- Engineered for long-term operation with resistance to electromagnetic interference
- Up to 50% lower power consumption, ideal for remote and solar-powered installations
- Intuitive web-based interface for fast setup, commissioning, and configuration



Distributed Temperature & Strain Sensing (DTSS)

DTSS provides benefits such as:

- Precise temperature and strain measurements based on the unique Brillouin technology
- Single-ended design – no loop required
- 80 km + measurement range with multiple internal optical channels
- High optical budget ensures outstanding measurement performance
- Practical and user-friendly web interface for easy commissioning
- Laser Class 1M with low optical output for safe operations



Conveyor Belt Fire Risk and Thermal Condition Monitoring

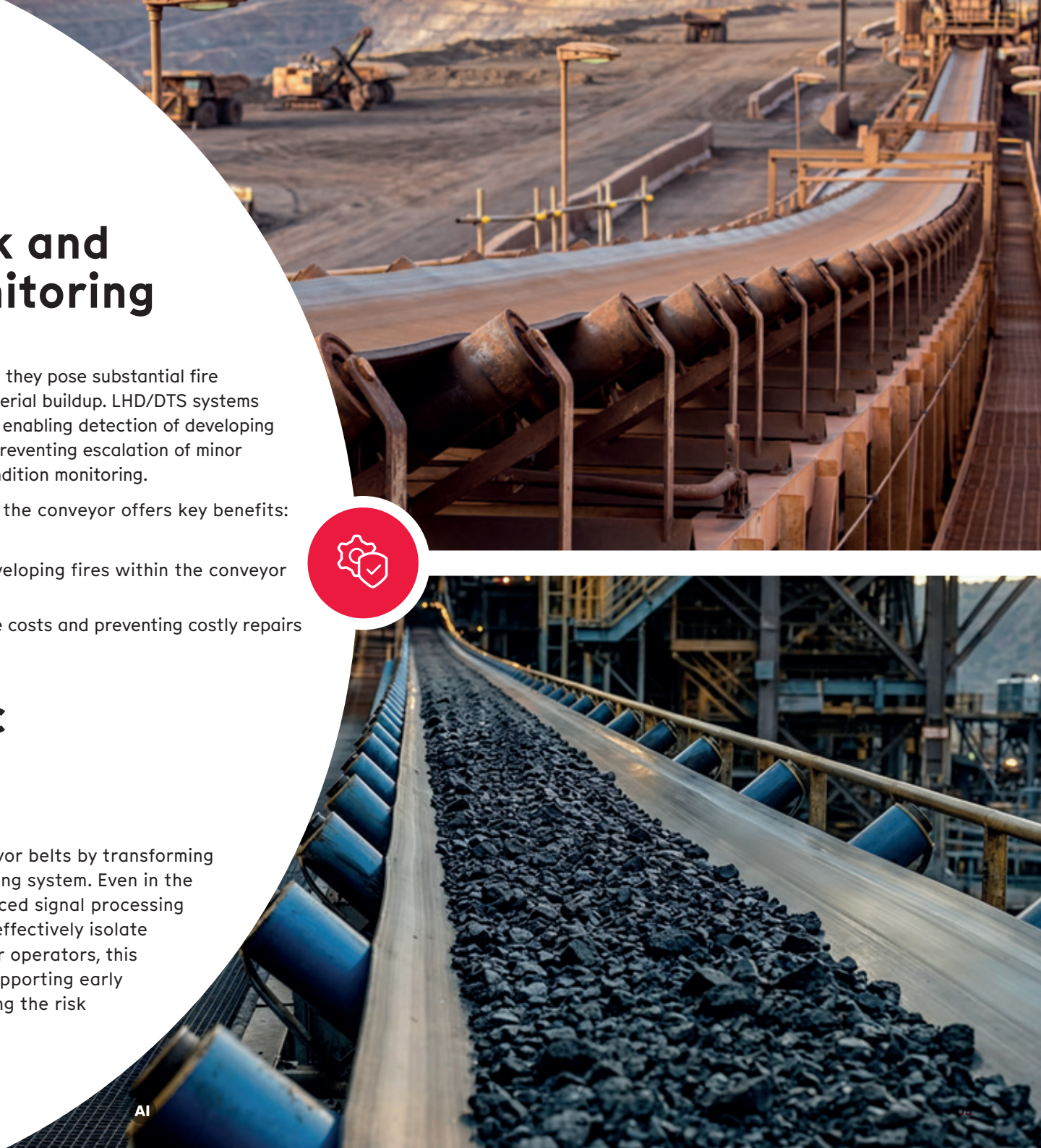
Conveyor belts are essential to many industrial processes, yet they pose substantial fire risks due to potential mechanical failures, overheating, or material buildup. LHD/DTS systems provide continuous monitoring along the entire conveyor belt, enabling detection of developing fire conditions and temperature-related anomalies. Thereby preventing escalation of minor incidents into major fires while supporting overall thermal condition monitoring.

The deployment of a passive fiber optic sensor cable along the conveyor offers key benefits:

- Minimized downtime and improved operational safety
- Precise detection and localization of overheating and developing fires within the conveyor belt structure
- Reduced need for manual inspections, lowering maintenance costs and preventing costly repairs

Conveyor Belt Acoustic Condition Monitoring

DAS enables continuous insight into the condition of conveyor belts by transforming a fiber optic cable into a real-time roller condition monitoring system. Even in the high-noise environment typical of mining operations, advanced signal processing and machine learning techniques applied to DAS data can effectively isolate vibration signatures and detect developing roller faults. For operators, this provides a simple yet powerful indicator of roller health, supporting early intervention, reducing manual inspection effort, and lowering the risk of unplanned downtime.



Fire Detection in Power & Electrical Equipment

Identifying Overheating in Real Time

Electrical infrastructure, including surface and underground power cables, cable trays, substations, transformers, and switchgear represents a critical fire risk in mining environments. Overloading, insulation degradation, loose connections, and short circuits can lead to overheating and potential ignition, often in enclosed or hard-to-access areas.

With DTS, operators gain continuous thermal visibility across critical power assets. Fiber optic cables installed along cable routes and around key components detect abnormal temperature rises in real time, enabling early warning of developing faults. The fiber optic cables and the measurement will not be influenced by electromagnetic interferences (EMI).

This proactive monitoring approach helps prevent electrical fires, reduces unplanned outages, and enhances protection of high-value equipment and personnel.



Pipeline Monitoring

Detecting Leaks and Anomalies

Pipelines are vital to mining operations, transporting slurry, tailings, water, chemicals and other essential fluids across vast and often remote areas.

Their continuous operation is critical for production, yet they face risks such as leaks, blockages, erosion, and ground movement that can lead to costly downtime or environmental damage. Because these pipelines are difficult to inspect and failures can escalate quickly, reliable monitoring systems are essential.

DFOS offers a way to detect problems early, ensuring safer and more efficient pipeline management.

DFOS systems are applicable for various pipeline in mining sector:

- Slurry pipelines
- Tailing pipelines
- Water pipelines
- Chemical pipelines



Mining Perimeter Monitoring

Intrusion Detection

Mining sites often cover vast, remote areas where conventional security measures can be difficult to implement effectively.

DFOS provides a robust solution by turning perimeter fences and buried cables into continuous, intelligent sensing lines.

It enables accurate detection of intrusion attempts such as fence climbing or cutting while filtering out environmental noise. In addition, it ensures immediate recognition of cable tampering or sabotage and remains reliable even under environmental disturbances like wind, rain, or wildlife, keeping false alarm rates low.



Tailings Storage Facility Monitoring

Tracking Seepage and Stability

Ensuring the stability of tailings storage facilities (TSFs) is a growing concern worldwide. One of the critical factors is the presence and movement of water within the structure. Seepage and the formation of weak layers in the dam or foundation soil are among the leading causes of failures.

Recent incidents at tailings dams have underscored the importance of continuous monitoring, yet developing solutions that are permanent, non-intrusive, and cost-effective continues to be a major challenge.

DFOS offers a powerful tool for this task, enabling continuous, real-time measurements of temperature, acoustic signals and strain along the full length of an installed cable.

This makes it possible to detect seepage paths, monitor settlement, and identify changes in dam behaviour at an early stage, providing valuable information for risk mitigation and safer operation of tailings dams and TSFs.



Seismic Monitoring with DAS

High-resolution Subsurface Insights

DAS is an emerging technology in the mining sector, gaining growing attention for high-resolution seismic monitoring using fiber optic cables. By turning fiber infrastructure into continuous sensor arrays, DAS enables real-time data acquisition across large and otherwise difficult-to-access areas.

In passive seismic applications, DAS captures rockmass response, including microseismic events, fracturing, and stress changes within the rock mass. It is also increasingly used in active seismic methods, such as surface seismic exploration and vertical seismic profiling (VSP), supporting improved imaging of subsurface structures and more accurate characterization of orebodies and geological features.

DAS can serve as a practical complement or alternative to conventional seismic sensors in imaging-focused applications. Overall, it enhances both exploration and operational safety by delivering dense, continuous seismic data.





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