Electric Leak Detection and Leak Location on Geosynthetic Liners in the Mining Industry

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A Fact to live with

The Truth About Leakage –

All liners leak...

...eventually
An electric current is induced within the containment structure.

In the presence of leaks, the current flows more readily, resulting in a larger magnitude response near a leak location.
Electric leak location is governed by:

- The inverse relationship between the conductive nature of boundary materials and the highly resistive nature of most geosynthetics.

A hole:

- Breaches the liners resistive nature
- Creates a local region of high conductivity

Therefore:

- The electric potential relative to a hole in the liner is significant and measurable
- Current levels remain low and uniform across intact and undamaged liner.
Bare Liner Leak Location

Water Puddle
&
Water Lance
Transmitter Setup
Transmitter & Transmitting Electrode Setup
Challenges with successful leak location surveys fall into two main categories

• Human Error
• Equipment Limitations
Operators must consider:

- All the elements in contact with the margins of the geosynthetics in a lined system
- How well the substrates below and above the liner can carry current
- The quality of electrical isolation in the area to be surveyed
• Geometry not considered.
• Maximum distance between survey lines determined incorrectly
• Lack of routine following sensitivity test throughout survey
• Survey electrical array set up incorrectly - liners have caught on fire from improper transmitter setup
• Suspected leaks marked incorrectly
Human Error

Exhaustion & Complacency During Physical Data Acquisition
Low Level Automation

Contemporary leak location equipment for covered systems is typically divided into two separate components:

A current injector (transmitter)
A current detector (receiver).

This lack of connectivity means that system checks are operator-dependent rather than system-dependent.
Survey Area Limitations

Fluid depths need to be lowered to levels that an operator can operate in easily.

Total survey area is reduced to the water level of the pond.
Survey Area Limitations

For material covered liners in mining, leak location equipment is limited by the depth of the material.

As the depth of material increases, and since the injected current density will decrease with increasing depth, at some depth the resulting signal cannot be distinguished from background noise.
Resolution in Conductive Substrates

- Conventional leak location systems break down in highly conductive solutions or substrates.

- Current leaking through a hole is attenuated to such an extent that the signal falls below the detector’s ability to resolve it.

Signal Shadowing

- It is extremely difficult to resolve smaller holes in close proximity to larger ones.

- Large tears or punctures creates a much larger signal pathway. High current flow floods the immediate area, shadowing or obscuring the location of smaller holes nearby.
The Future of Electric Leak Location