The Miners Guide to Liner Leak Location

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The Truth About Leakage –
All liners leak...

...eventually

Liner Integrity depends on construction quality and maintenance through end of life.
Why Care About Leakage
Obvious, but lets break it down


• Financial Impacts
  – Product loss
  – Litigation – fines

• Liability Impacts
  – Operations challenges – current and future
  – Public image
  – Environmental cleanup

• Quality & Stability of the structure and related infrastructure
  – Leakage can create saturated soil conditions adding stress to the system
What is the value of Leak Location
Mitigating costs!

• Regulatory compliance
  – No fines or minimal fines

• Potentially major cost savings
  – Product loss is minimal
  – No Litigation or court costs
  – Costs are limited to survey and repairs costs

• Liability Impacts
  – Operational challenges solved
  – Public image maintained and possibly improved (took action)
  – No or limited environmental cleanup

• Quality and stability of the structure is maintained
Unlined ponds leached Chromium-6 into the groundwater causing cancer and autoimmune disease.

Leakage occurred between 1952 – 1966
From 1996 to 2008 settlement costs reached $448 Million
Cleanup cost $700 Million.
Total cost is upwards of $1.1 billion and counting.
Liner Leak Location Methods
Two types - bare or covered

Bare Liner

- Water Puddle - ASTM D7002
- Water Lance - ASTM D7703
- Spark Testing - ASTM D7240
- Arc Testing - ASTM D7953

Water Covered & Soil Covered

ASTM D7007
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.
Electrical Leak Detection Basics

Electrical Response Map

Reds and yellows represent low uniform current levels across intact and undamaged liner while blues, greens, and purples show significant and measurable electric potential relative to a hole in the liner.
Survey Setup
Walking, floating, or towed probe
Electrical Leak Detection Basics

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Survey Setup
Multi Sensor Approach
Electrical Leak Detection Basics

Survey

Reds and yellows represent low uniform current levels across intact and undamaged liner while blues, greens, and purples show significant and measurable electric potential relative to a hole in the liner.
What you need to know
Perpetration for a liner leak detection survey

Structure & Site Information Package
Safety Plan
Electrical isolation action items
Liner Survey
Repairs
What do you need to know
Basic questions from service providers

**Scheduling**
- How quickly do you need a proposal – when do you want to start work?
- Will work be impacted by weather – regulatory constraints – site schedules?
- Why do you need a survey? Suspected leak – integrity assurance – regulatory required?

**Site Locations & structure conditions**
- Where is the site(s) located - *provide Google Earth KMZ –
  ***provide current on the ground photos
- What is the size of the structure (L-W-D) – provide engineering plans – what is it used for?
- How do you know you have a leak – what is the leak rate – how long has it been leaking?

**Survey design questions**
- Can work vehicles operate around the pond – are there fences or concrete barriers within 25’?  
- Any grounded electrical systems – any pipes and what are they made of – do they penetrate the liner?
- Any debris, dirt, sand, gravel covering the liner below waterline – is there a cover (bird balls or netting)
- What kind of liner – single or double lined – what type of solution is in it now – what’s the PH?
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.
What you need to know
Safety Plan

Safety Plan → Electrical isolation action items → Liner Survey → Repairs
What your contractor needs to know

Safety Plan

Build a “H&S Document Package” specific to pond leak location for your site

Site Specifics & Structure Specifics

- Does the contractor need PFD’s
- Lockout tag out requirements
- Vehicle operation around structure (Includes trucks - UTVs’ - ATV’s - Mountain bike)
- Equipment inspections
- Fall protection (Rope & Harness Training)
- Solution specific training (bio hazard - radiological hazard - highly acidic or basic)
- Special PPE such as chemical resistant gloves, face shields, and clothing
What you need to know
Electrical Isolation

Electrical isolation action items

Liner Survey

Repairs
Isolation Conditions

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
What you need to know
The Survey

Liner Survey
Repairs
What you need to know
The Survey
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.
Questions... Thank you!