ELECTRICAL LEAK LOCATION - AN ESSENTIAL WEAPON IN THE BATTLE FOR CONTAINMENT - THE DEATH OF LEAKS?

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WHAT IS ELECTRICAL LEAK LOCATION TESTING?

- Electrical Leak Location (ELL) Testing is a method by which breaches in installed geomembrane can be identified.
- It is an effective and proven quality assurance method to locate leaks in installed geomembranes.
- There are various techniques to carry out ELL testing and the selection of the appropriate technique is dependent on the site specific conditions.
- ELL Testing can be carried out on the following applications:
  - Exposed Geomembranes
  - Earthen Material-Covered Geomembranes
  - Water-Covered Geomembranes
- This presentation will focus on the Arc Testing Method for exposed geomembranes and the Dipole Testing Method for covered geomembranes.
ELL ON EXPOSED GEOMEMBRANES USING THE ARC TESTING METHOD (ASTM D7953-14)

- The Arc Testing ELL Method is used on applications where the installed Geomembrane is exposed or uncovered.
- The schematic below shows the components and setup of the test.
ELL ON COVERED GEOMEMBRANES USING THE DIPOLE TESTING METHOD (ASTM D7007-16/ ASTM D8265-19)

- The Dipole Testing ELL Method is used on applications where the installed Geomembrane is covered with water or an earthen material.
- The schematic below shows the components and setup of the test.
HOW DOES ELL WORK?

- A high voltage is applied on/over the geomembrane (depending on the technique required).
- The power source (negative) is grounded to the conductive material under the geomembrane.
- Voltage measurements are taken in a grid pattern over the area to be tested.

VOLTAGE MAP FROM AN ELL SURVEY
WHY IS ELL TESTING AN IMPORTANT TOOL IN THE QUALITY ASSURANCE PROCESS?

- The geomembrane in lining systems is the primary barrier to ensure containment at facilities.
- Reducing the leak rates of facilities reduces the risk of contamination.
- Majority of liner defects occur during the construction phase (either during deployment or more commonly during the placement of the cover material).
- Once covered, damages are no longer visible to the human eye.
- Contractors pay more attentional to quality control during construction, ELL may expose errors that occurred during the construction.
- Human error has to always be considered.
DAMAGE CAUSED BY MACHINERY USED TO SPREAD THE DRAINAGE STONE
DAMAGE CAUSED BY MACHINERY USED TO SPREAD THE DRAINAGE STONE
PROTECTION GEOTEXTILE PULLED AWAY AT THE BONDED OVERLAP

THE RESULTING DAMAGE TO THE HDPE CAUSED BY TRAFFIC OVER THE DRAINAGE STONE
A DAMAGED AREA OF HDPE POSSIBLY CAUSED BY THE METHOD OF PLACEMENT OF THE DRAINAGE MATERIAL OR INADEQUATE PROTECTION LAYER OVER THE GEOMEMBRANE.
DAMAGE TO THE HDPE CAUSED BY A DOZER BLADE
DAMAGE TO THE HDPE CAUSED BY A DOZER BLADE
THE OLD TIME FAVORITE..... SURVEY PEG THROUGH THE LINER
DOES ELL REPLACE THE NEED FOR CONVENTIONAL CQA?

- ELL is an additional layer to the CQA process.
- The purpose of ELL is to detect physical damages on the HDPE geomembrane that may be caused during the covering of the geomembrane or not visible to the human eye during visual inspections.
- CQA is a plan of activities that are carried out to ensure that the construction process is carried out to the standard of the design specifications.
- Research has shown that lined facilities without adequate CQA have higher leakage rates than sites with adequate CQA.
When designing leak detection systems, designers typically use 3 - 5 leaks per hectare (usually a few millimetres in diameter) to determine the Action Leak Rate (ALR).

- 70% of all defects are attributed to backfilling operations over the installed liner.
- Studies have shown that when no ELL is conducted on a lined facility, the probability of exceeding the specified ALR is 23% -25%.
- When doing ELL on the covered geomembrane using the Dipole method this figure drops to 7% - 9%, **(64% LESS!!)**.
- When doing ELL on the geomembrane prior to covering (Arc Test) and after covering (Dipole Test) the probability of exceeding the ALR drops significantly to only 0.0001%.
WILL ELL GUARANTEE A LEAK FREE FACILITY?

- The performance of ELL is primarily based on site specific conditions and leaks can be missed for various reasons.

Conditions:
- The covered area to be tested needs to be electrically isolated.
- The material below the Geomembrane must be conductive (i.e. the prepared subgrade or GCL).
- Measures should be taken to ensure that wrinkles are minimized for earthen covered geomembranes.
- Site specific trial testing and calibration must be carried out prior to the actual test.
- For testing on earthen covered-geomembranes the cover material must be adequately wet prior to testing.
- ELL will only detect actual leaks in the geomembrane but not damage to the geomembrane that may just reduce its service life.
IMPROPER ISOLATION THAT COULD CAUSE FALSE READINGS DURING THE ELL SURVEY
DAMAGED HDPE GEOMEMBRANE WITH NO PENETRATION, THIS WOULD *NOT* BE DETECTED BY ELL, BUT WILL REDUCE THE INTEGRITY OF THE GEOMEMBRANE
WATER DRIPPING FROM FITTINGS ON WATER TRUCK, THIS CAUSES EARTHING AND MAY LEAD TO FALSE READINGS
CONCLUSIONS.....

- ELL is an essential tool that can be used as part of the CQA process to provide a higher level of assurance that the lined facility is leak free.
- ELL does not guarantee a leak free facility due to site specific conditions but does reduce the risks associated with leaks in geomembranes.
- Studies have shown that proper CQA does reduce the frequency of damages/leaks found on the lined facility prior to carrying out the ELL survey *(CQA IS ESSENTIAL!!)*
- Designing for ELL is essential if ELL is specified or required. This will ensure that the site conditions provide the best possible conditions for leaks to be detected.
THANK YOU...

EVERY SMALL STEP IN THE RIGHT DIRECTION COUNTS

ANY QUESTIONS?