LOCATING LANDFILL LEAKS COVERED WITH WASTE

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SUMMARY**:** A newly constructed single-lined geomembrane municipal solid waste (MSW) landfill cell developed leaks after two to five meters of waste were placed in the cell. The primary liner was initially leak tested using an electrical leak location method after the protective drainage soil was placed on the liner. All leaks that were located were repaired. Therefore, the reported leakage was caused by damage to the liner during the placement of the waste material. Because the landfill had up to five meters of waste material covering the liner, a standard electrical leak location survey was not practical. Therefore the newly-developed Electrical Leak Imaging Method (ELIM) was used to locate leaks. Three leaks were located using ELIM. The leaks were repaired and no further leakage has been reported.

1. INTRODUCTION

Locating leaks in geomembranes after installation is an essential element to insure that the lined facility is functioning as designed. Typical field test methods for locating leaks in liners include: vacuum box, air pressure, spark test, dye, and electrical leak location. The only method that is capable of accurately locating leaks in the geomembrane after a protective soil cover is placed over the liner is the electrical location method.

An advancement of the electrical leak location method is the Electrical Leak Imaging Method (ELIM). This method can be used as a permanent monitoring system or as a mobile system to solve leak problems in operational landfills.

The ELIM method detects electrical paths through the geomembrane liner caused by water or moisture in holes through the geomembrane liner. A voltage is connected to one electrode placed in the soil covering the liner and to a second electrode placed in the leak detection zone for double-lined systems or in earth ground for single-lined systems.

Electrical current flowing through the leaks in the liner produces localized anomalous areas of high current density at the leaks. These areas are located by making potential measurements around the perimeter of the landfill or with widely spaced grid of electrodes on the floor area of the landfill cell. The data is then processed using specialized imaging software to locate leaks in the geomembrane liner.

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2. ELIM LANDFILL SURVEY

A recent application of ELIM was used to locate leaks in a one-hectare single-lined municipal solid waste (MSW) landfill in northern Italy. A standard electrical geomembrane leak location survey (GLLS) was performed on the geomembrane after the protective soil was placed over the liner. Leaks located with GLLS were repaired before waste was placed in the landfill. However, leachate was detected below the liner after two to five meters of waste bad been placed in the landfill. Therefore a method was needed to locate the leaks under the waste before landfilling could continue. The ELIM method was used to locate the leaks.

2.1 Landfill Description

The landfill cell is lined with a single 2.5 mm HDPE liner and has a floor area of approximately one hectare. A thick geotextile was placed on the liner prior to covering the floor with one meter of course drainage gravel. The waste was covered with 30 cm of graded soil.

Leak monitoring for the landfill cell was provided by groundwater monitoring wells placed down gradient from the landfill. Figure 1 shows a view of the landfill cell.

A leak was suspected in the primary liner because of the elevated levels of pollution indicators such as COD (Chemical Oxygen Demand) and Chlorides (Cl) measured in the groundwater monitoring wells.

2.2 Survey Procedure

The ELIM survey was conducted after two to five meters of waste was placed in the landfill cell. Therefore, the total thickness of material covering the primary liner ranged from three to six meters because of the protective drainage material covering the liner.

To make the electrical measurements, a voltage was connected to one electrode placed in the waste material covering the liner and to a second electrode placed at a remote location outside of the lined area. The potential relative to a second remote electrode was then measured on a 10 m by 10 m spacing over the floor area that was covered with up to 5 m of waste. Figure 2 shows the survey layout.

Figure 1. Photograph of Landfill Showing Survey Area

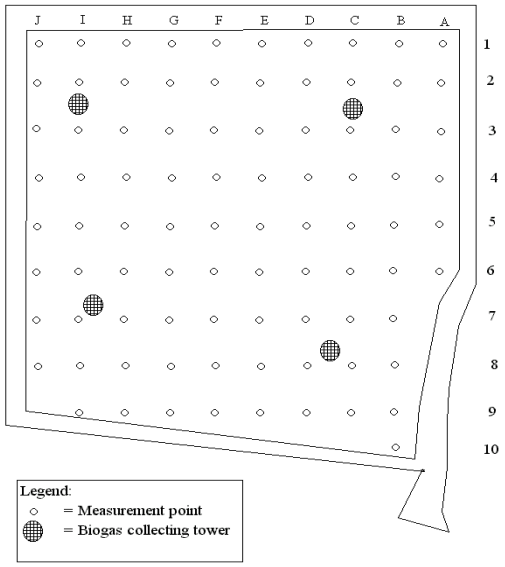


Figure 2. Drawing Showing Survey Grid

3. SURVEY RESULTS AND DISCUSSION

Figures 3 shows a shade-of-gray display of the processed ELIM data. This data clearly shows three distinct leak signals. Each of the features was excavated to expose damage to the primary liner above the protective drainage gravel. Therefore, the damage was caused during the placement of the waste material. Leak "A" was a large tear in the liner measuring 63 cm by 31 cm. Leak "B" and "C" were holes in the liner caused by mechanical damage. Leak "B" measured 10 cm x 5 cm and leak "C" measured 5 cm x 3 cm. No leaks were found on the bottom floor area. The floor area covered with a protective drainage gravel was previously inspected by a GLLS® before waste was placed in the landfill cell. The GLLS® was used as the final Construction Quality Assurance (CQA) test of the lined floor area

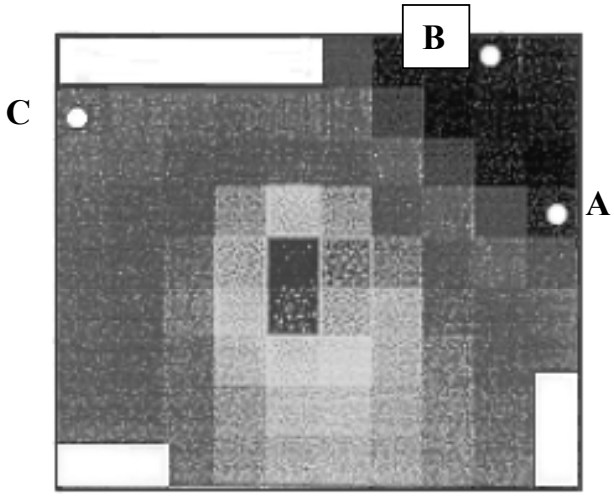
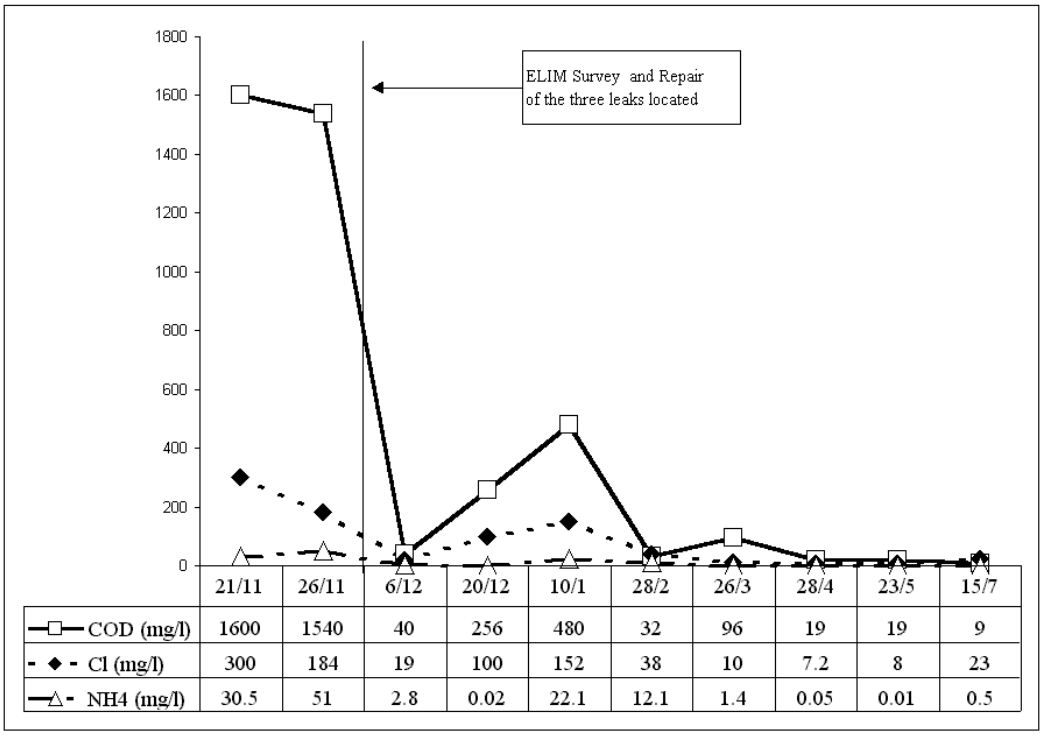


Figure 3: Plot of ELIM data collected at the landfill showing three leak signals (Position "A" 63 cm x 31 cm tear. Position "B" 10 cm x 5 cm hole. Position "C" 5 cm X 3 cm hole)

4. CONCLUSIONS

An ELIM survey was used to accurately locate leaks in a geomembrane-lined landfill cell with up to 5 m of waste. Measurements were collected on the waste using a widely spaced electrode grid. This allowed fewer data points to be collected which saved time and money in identifying the leakage problem.

The leaks were repaired and no further leakage was reported from the landfill site. This was confirmed by the groundwater monitoring data presented in Figure N° 4 showing the elevated pollutant levels returning to zero after the ELIM survey was conducted and the three located leaks repaired. The variations in the curves are due to rain episodes on the area.



	21/11	26/11	6/12	20/12	10/1	28/2	26/3	28/4	23/5	15/7
COD (mg/l)	1600	1540	40	256	480	32	96	19	19	9
Cl (mg/l)	300	184	19	100	152	38	10	7.2	8	23
NH4 (mg/l)	30.5	51	2.8	0.02	22.1	12.1	1.4	0.05	0.01	0.5

Figure 4: Plot of Groundwater Monitoring Data Indicating High COD and Cl Levels (Note: pollutant levels decreased after leaks located with ELIM were repaired)

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