Study of necroleachate migration in saturated and unsaturated zone through geophysical methods.

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Abstract

The objective of this study is to is monitor the degradation of the body of a pig using Electric Imaging and GPR in an area with water table near the surface by detecting variations in conductivity in the soil and the saturated zone during two hydrological cycles.

The experiment took place in a private area in the city of Aveiro, Portugal. Multi electrode cables were built by the project team and installed vertically in the area for electrical imaging and also GPR surveys in regular mesh were taken.

The preliminary results indicate a important decrease of conductivity even with the influence of rain. Problems with the equipment indicate that a new experiment must be repeated in Brazil, with more control on the area access.

Keywords: Cemetery contamination, groundwater, geophysics.

Introduction

Studies aimed to characterize or identify areas legally or illegally used as cemeteries using geophysical methods such as GPR and Electrical Imaging have varied results. Some studies show increase of conductivity in soil and groundwater due to the necroleachate components as in Pacheco (2000), Pacheco et all (2004), Senos Matias et all (2004) and Spongberg & Becks (2000) but recent studies show decrease of conductivity, probably due to the fat liberated by the decomposing bodies.

Studies in a restricted or controlled area developed by Freeland et. Al. (2003) and Saraiva (2010) show good results especially in low depths but the behavior of the leachate in the saturated zone remains with no definitive answer.

The present project proposes the comparative study of the methods most widely used in environmental assessment of contaminated areas, seeking a result that represents more possible loyal conditions of existing subsurface contamination in the area affected by the liquid from decomposing bodies, known as necroleachate.

The simultaneous use of two methods in the same study site will allow correlations and reviews the effectiveness of the same front of the particular type of problem to be solved.

Method

The research was developed in a private area in Aveiro with intense occupation by houses and agricultural activity (Figure 1).

Figure 1 - Neighborhood of the experiment area near Aveiro, Portugal. Image: Google earth ®.

As a part of the project, three eight-way cables were used for building electrodes, installed in polyvinyl chloride (PVC) tubes, leaving part of the copper wire on the outside to allow contact with the ground (Figure 2).

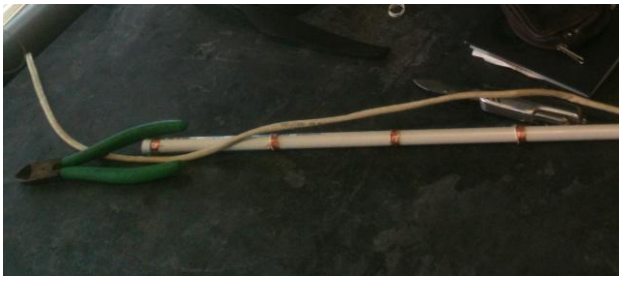

Figure 2 - Part of an electrode built for the experiment.

Before the experiment some analysis and drilling were conducted, indicating the water table depth close to the surface, about 1 meter.

After that , it was then open a grave with 1.0 x 0.6 x 0, 5m, where the electrodes were placed vertically (Figure 3) and a complete survey took place to determinate the underground conditions without the pig body.

Figure 3 - Electrodes placed in the experiment area.

Them the animal body was placed directly in the ground in a reopened grave between electrodes. it was immediately covered as occurs in a human burial and made another measurement survey (Figure 4).

Figure 4 - Pig body being recovered with soil.

Results

Conductivity measurements before and after deployment of the body clearly shows variations due to this change in the subsoil. The measures taken during the days that followed the body deposition also showed variations, with increased resistivity (Figure 5).

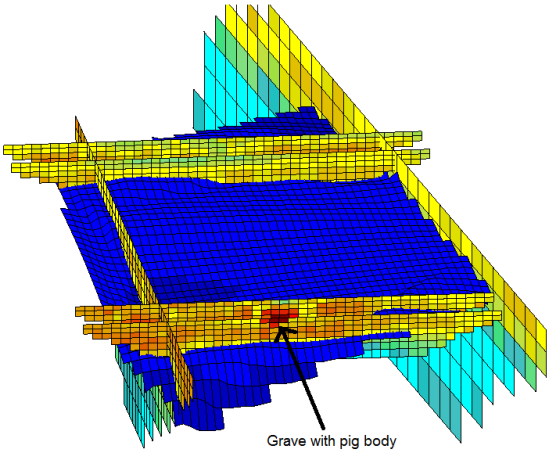

Figure 5- 3D diagram of the area showing resistivity increase after body implantation.

The GPR survey results indicated anomalies associated to the body deposition but as far, no great changes in subsurface due to body decomposition.

Figures of these results are being prepared and should be presented during Congress.

Conclusions

Geophysical methods used in this research have differently efficiency to evaluate ground conditions before and after body deposition.

The results obtained from Electrical Imaging method show clearly differences on subsurface before and after the body deposition in soil. The measures taken after the body installation showed great variations, with increased resistivity instead of decreasing, as might be expected from the presence of salts from the leachate.

Problems occurred in on electrode are forcing the team to restart the research. The new area should be installed in a area with no other uses, such as this is used for agriculture a few meters beside the grave.

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