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Mapping the Electric Fields for Geotechnical Applications

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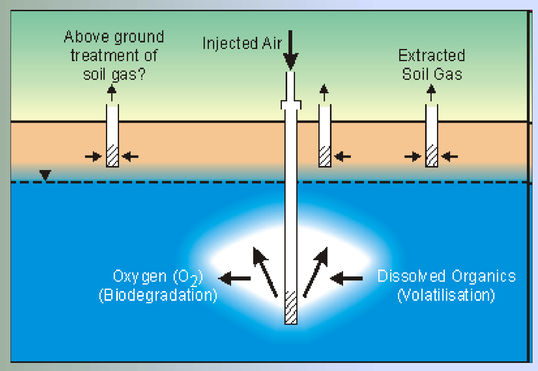
Project Background

Volatile Organic Compounds(VOC's) such as gasoline are contaminating our country's groundwater. From leaky underground tanks to hazardous spills, which put our groundwater at risk and will potentially contaminate our drinking water. Air sparging is used to clean up these harmful chemicals. However, air sparging is a slow process taking months or even years to reach acceptable contaminate levels. Air sparging uses an air injection well to pump air into the contaminated ground water. The harmful chemicals are volatilized as the air rises to the surface and removed with soil vapor extraction wells.



An injection well pumps air into the contaminated ground water

Project Objectives

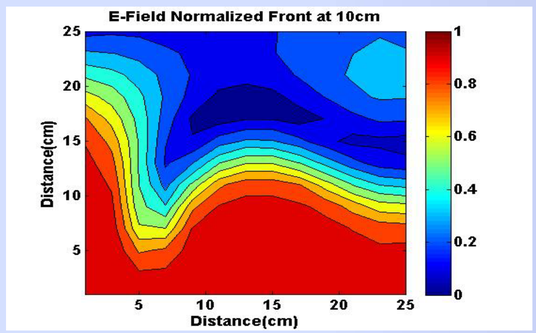
Our ultimate goal is to study the effects of electromagnetic (EM) stimulation on air sparging. The first objective, to reach this goal, is to investigate the correlation between the EM-stimulation power and frequency, to the change of the transport rate of a non-reactive dye in water to study the stimulating effects of electromagnetic waves.

Technical Approach

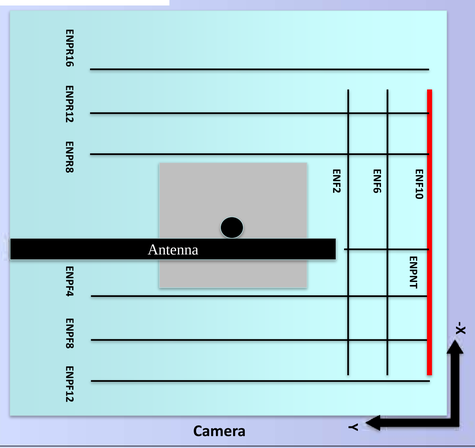
- Measuring transport diffusion rate with digital imaging with and without electromagnetic stimulation.
- To correlate the transport measurements to the field a field map must be created.
- To map the electric field, we use a robot (3D antenna positioning table) to move a probe in three dimensions on Cartesian coordinates in the incremental mapping of the apparatus.
- A program is written in LabVIEW to move the robot.
- The same LabVIEW program synchronizes with the spectrum analyzer to record power measurements.

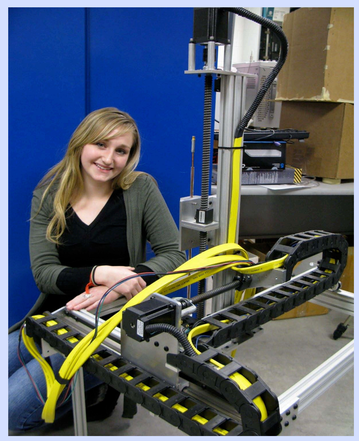
Results:

The contoured plot below represents the magnitude of the normalized electric field in the box on a depth slice.



The picture to the right represents the area probed in the box.





Conclusions/Discussion

Using the robot to probe the field was successful. The data collected was used to map the electric field, which contributed to our understanding of the electromagnetic stimulation. LabVIEW proved to be an effective tool for directing the robot and recording the power.

Air Sparging Project

The relationship between transport rate and stimulation is still being studied.

Acknowledgements

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