

**POLITECNICO DI MILANO**  
Scuola di Ingegneria Civile, Ambientale e Territoriale



**POLO TERRITORIALE DI COMO**

**Master of Science in  
Environmental and Land Planning Engineering**

# **Application of Ground Penetrating Radar in Detecting Soil Contaminants**

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**Corso di Laurea Specialistica in  
Ingegneria per l'Ambiente e il Territorio**

## **Uso del GPR per la Rivelazione di Contaminanti**

**Relatore: Prof. Giancarlo Bernasconi**

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**Anno Accademico 11/ 12**

## **ABSTRACT**

Sub-surface contamination mainly by Light Non-Aqueous Phase Liquids (LNAPLs) is one of the most pressing issues of the environmental world. LNAPLs have densities less than that of water, are not miscible with water but have some characteristics of water. LNAPLs are potential long – term sources for continued groundwater contamination at many different places. The most common source of LNAPLs is from the release of petroleum products into the subsurface.

This thesis discusses the use of the GPR in the detection and location of the contaminant plumes. GPR is a geophysical technique that can be used to investigate and map the dielectric properties of the subsurface. The application of ground penetrating radar (GPR) to delineate the subsurface targets are enormously growing up and improving. Non – invasive and non – destructive methods, of which GPR is part, have proven to be well-versed in the investigation of the sub-surface. Radar data can be used to detect the presence of LNAPL which have dielectric properties distinctly different from those of the soil matrix and fluid components in the subsurface. The resolution of the radar image which is normally represented on a radargram gives a clear picture of the subsurface which defines the fate and transport of the LNAPL. The good penetration and high resolution of GPR has made it an attractive alternative to the traditional methods used for subsurface characterization.

Keywords: Light Non-Aqueous Phase Liquid, Ground penetrating radar, Soil contamination.

## **DEDICATIONS**

1. This thesis is dedicated to my family especially my father, the late Robert Kwame Mensah, whose sudden death inspired me and served as a great challenge to me to fulfill this dream. I thank Rosamond Bentoom(mother), Anne-Marie Mensah (sister), Emmanuel Kweku Mensah (brother), Francis Apam Gariba and Wintis Apam Gariba(niece) for your loving support and prayers from the beginning of my studies till the end.

I also dedicate this thesis to Mr. and Mrs. Adu – Gyamfi of Erba, the Mobenda family of Fenegro, the Methodist Church Choir of Como. Thanks very much for your support.

Finally, I dedicate this thesis to all my friends, my loved ones and to those who believe in the richness of learning.

2. I dedicate this thesis to my wife, Gina, mother and my late father, siblings and all my friends.