

# Design of Ground Penetrating Radar Antenna for Detecting Soil Contamination at L-band Frequencies

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**ABSTRACT** Maintenance of oil pipelines is an issue of great concern for oil companies. Soil contamination is caused by oil leaks from underground pipelines. Ground penetrating radar (GPR) is a rapid and relatively inexpensive technique used for locating and characterizing soil contaminated sites without producing fractures and causing further migration of contaminants. One of the most critical hardware components for the performance of GPR is the antenna system. The present paper reports on the design and simulation of a pyramidal horn antenna operating at L-band frequencies (1- 2 GHz) to detect soil contamination. A prototype model of the GPR system setup is developed to simulate the electromagnetic fields in different soil types. The dielectric permittivity of soil, needed in order to carry out simulations during the design process, is measured and analytically represented by Debye relaxation model. The contrast in the dielectric permittivity between contaminated and uncontaminated soils is the most important parameter to be considered for detecting the presence of contamination. The application of GPR is proved to be well-versed in the investigation of soil contamination.

**KEYWORDS** Soil contamination detection, ground penetrating radar, permittivity measurement, pyramidal horn antenna design.

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