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Geophysical Investigations to Characterize Abandoned Gas Station Site Contaminated with Fuel Hydrocarbons: A Case Study in Korea

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ABSTRACT

Geophysical investigations, as a non-invasive, environmental sounding tool, were conducted to characterize a former gas station site contaminated with fuel hydrocarbons. Based on the results of the former environmental investigation of the service station performed years ago, there existed six USTs (Underground Storage Tanks) and two buried fuel lines connected to the gas pumps for feeding gasoline and diesel at the station, and the contamination of the soil and groundwater was attributed to the leaks of petroleum product from the USTs and buried fuel lines at the station. Years after the operation of the service station ceased and the station was abandoned, but the demolition of the buried objects such as USTs and fuel lines from the station was not known. During the geophysical investigations of this study, free product of petroleum hydrocarbons was identified in the monitoring wells at the service station, and also found in the soils adjacent to the small stream, located approximately 50 meters downstream of the service station in the southwest direction.

GPR (Ground Penetrating Radar) survey was performed to examine whether USTs and fuel lines are present at the service station and, if any, to locate them. As a result, six USTs (two diesel tanks and four gasoline tanks) and two fuel lines, as previously known were detected with GPR and one additional, unknown UST (which might have been buried much earlier than other USTs) was also detected with GPR at the station. It is thought that USTs and/or fuel lines might serve as an origin of the site contamination

for a long period of time in case any petroleum product was left in the tanks and fuel lines.

Electrical resistivity and additional GPR surveys were conducted to map water table and to characterize shallow geologic structures over the inclined area covered with grass and plants between the service station and a small stream. The results of the study, incorporated with soil boring logs, have shown that the shallow geologic structure includes: (1) upper soil unit of high resistivity values (mostly rock fragments with sand), (2) lower soil unit of low resistivity values (residual soils weathered from the bedrock), and (3) bedrock (granite) of high resistivty values. The results also show that the water table elevation varies with topography from approximately 1.5 to 3 meters below the ground surface, and that the water table is located in the lower soil unit weathered from the bedrock granite in the site. It is, therefore, believed that the free product leaked from the USTs and/or fuel lines at the station has migrated downgradient over the water table beneath the inclined area and encountered the small stream located southwest of the station, and that most of petroleum-impacted zone lies within the residual, weathered soil near the water table in the area. The study results also show that the geophysical methods can be a very useful tool for characterization of the contamination sites.

Key words: GPR survey, UST, resistivity survey, characterization

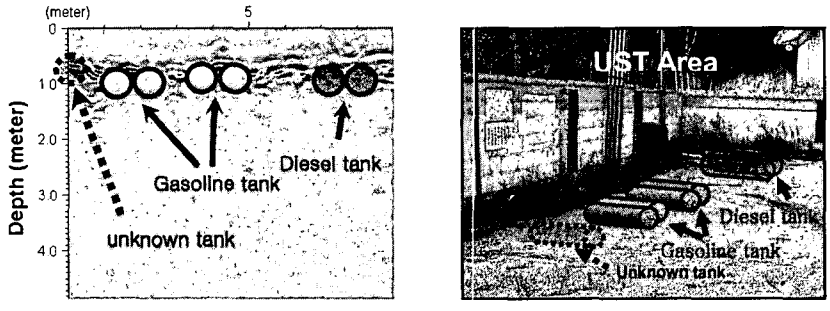

Fig. 1 2-D GPR image of buried objects (left), and area of buried USTs (right).

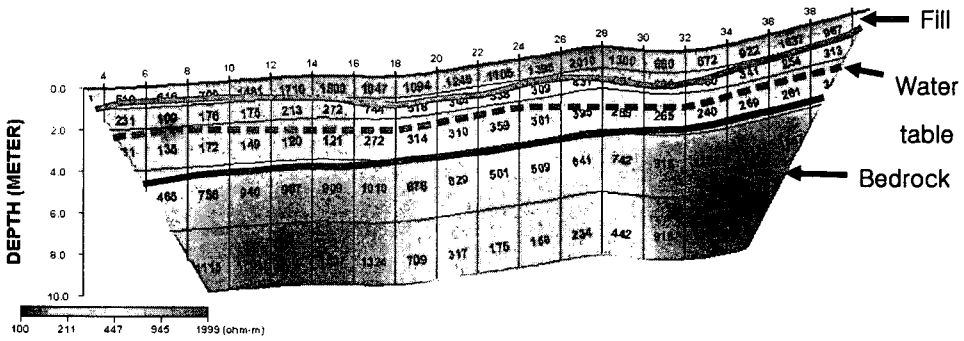

Fig. 2 2-D Resistivity image showing a shallow subsurface structure of the site.