

MIGRATION OF PETROLEUM FROM A TANK FARM INTO A FRACTURED BEDROCK AQUIFER IN THE PIEDMONT OF GEORGIA

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INTRODUCTION

An understanding of migration pathways utilized by liquid petroleum fuel as it travels from the near surface into the underlying bedrock can aid the investigator in assessing the relative risk of contaminant spread into a bedrock aquifer in the vicinity of a near surface fuel spill.

A site investigation conducted at a fuel tank farm concluded that fuel had migrated from the farm's waste fuel collection system into the fractured bedrock which underlies the site. The site is located in the Georgia Piedmont within the Brevard Zone (Figure 1) and is underlain by fractured and sheared granitic gneiss. The poster "A Cross Sectional View of Fuel Migration Pathways Resulting From A Near Surface Fuel Spill in the Piedmont of Georgia" illustrates one example of migration pathways utilized by fuel as it moves from the near surface into a bedrock aquifer.

CASE STUDY

During a routine underground storage tank removal, designed to replace an existing waste fuel tank with a new double walled fiberglass tank, a water and fuel mixture was observed to enter the excavation immediately after the tank was removed. Over a period of five days, in which the fluid was pumped out of the excavation on a daily basis, groundwater and fuel were observed to reenter the excavation from fractures in the bedrock along the bottom of the excavation. Analytical results from water samples confirmed the presence of dissolved fuel constituents in the groundwater.

An open excavation afforded an excellent opportunity for observation of the probable fuel migration pathways. A cross-sectional view of the waste fuel line and gravel-lined trench which extended from the tank farm to the old waste fuel tank was visible in the excavation. A pronounced fuel stain in the soil extended down about two feet from the gravel-lined trench and then horizontally about 15 feet along the western side of the excavation. Immediately after pumping out the excavation, raw fuel was observed to enter the excavation from about five feet below the stain.

Additional excavation in the tank farm indicated that the underground waste fuel line was corroded and leaking. Apparently fuel had leaked slowly from the fuel line and down the gravel lined trench which encased the line. From the bottom of the trench fuel appears to have infiltrated downward through a soil overburden until it reached a horizontal fracture located at or near the top of competent bedrock. From there the fuel apparently spread horizontally. A series of near vertical fractures which intersected the horizontal fracture appears to have provided the primary migration pathway for the fuel to move downward and into the groundwater. The fuel moved a minimum of ten feet vertically from the point of origin in the waste fuel line to the bottom of the tank excavation.



Figure 1. Brevard Zone Location
(Source: Georgia Geological Survey)

CONCLUSIONS

Within the Brevard Zone of the Georgia Piedmont it is apparent that near surface fuel spills occurring slowly over time can in some cases, easily migrate through a soil overburden and into a fractured bedrock aquifer where they become a groundwater contaminant. Information on the fractured nature of bedrock at such sites is critical in assessing the contaminant vertical migration.