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Forensic Geochemistry - The Key to Accurate Site Characterization

The majority of environmental site investigations are conducted using a limited number of randomly placed boreholes and/or monitoring wells in an attempt to characterize the subsurface contamination. Although costs often dictate the approach and work plan executed during an investigation, the key to an accurate site characterization is the use of forensic geochemical techniques. A well formulated work plan using forensic geochemical methods can accurately delineate subsurface contamination, and ultimately be more cost-effective.

Previous environmental investigations at a refinery, using randomly placed monitoring wells, indicated a very large liquid crude oil contaminant plume along the south boundary of the facility, which was projected to continue offsite into a residential area. When crude oil was discovered seeping into the adjacent bay, it was assumed the source was related to the south boundary plume.

A soil-vapor survey was conducted to delineate the areal extent of subsurface contaminant plumes. Over 3150 soil-vapor samples were collected on a 30-meter grid. Soil-vapor plume maps indicated the south boundary plume was made up of smaller, independent pods. Product 'signatures' determined from soil-vapor samples using high resolution capillary gas chromatography (HRCGC) were confirmed by analyses of product samples from the 105 monitor wells installed based on the soil-vapor plume maps. Data obtained from the soil-vapor survey and monitoring wells allowed for delineation of both the horizontal (areal) and vertical extent of specific contaminant plumes. Chemical fingerprinting (HRCGC) of vapors, sediment and fluids was essential in the identification of distinct plumes/pods.

Results indicate that earlier estimates of free product (NAPL) contamination were excessive. Using a forensic geochemical approach, an accurate assessment of the facility (and product volume) was performed. It was determined that the adjacent residential area contains only minor subsurface contamination and the source(s) of liquid contaminants seeping into the bay are unrelated to the south boundary contaminant plume.