State Regulatory Oversight of a Pilot Horizontal Well for DNAPL Recovery: A Case Study

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Pre-RCRA disposal of still bottoms, sludge and waste product occurred onsite in unlined pits at a chlorinated solvent manufacturing facility. Pits were excavated in unconsolidated sediments of Holocene age, which are underlain by Pleistocene clays, channel sands, and massive sands of the Chicot Aquifer. Waste materials containing significant amounts of chlorinated solvents have undergone gravity separation and formed a Dense Nonaqueous Phase Liquid (DNAPL) layer within the uppermost sediments.

Well points connected to a vacuum recovery system installed in the early 1980's attempted to recover contaminated groundwater. The true extent of DNAPL was not realized until evaluation of this system proved that recovery was not providing significant reduction in contaminant levels. Upon further study, it was realized that the vacuum system could not recover the dense phase material, and only recovered the dissolved portion.

The Agency (LDEQ) requested further augmentation of the system or alterative methods to efficiently and effectively recover DNAPL. The Company has initiated the installation of a pilot horizontal recovery well. Advantages of horizontal over vertical wells include: fewer surface locations and appurtenances, greater capture zone, cost reduction for maintenance and accessories, lower worker exposure, and greater effectiveness in DNAPL recovery. Anticipated problems include preventing worker exposure to waste materials, maintaining vertical emplacement control, preventing loss of mud through surficial pathways, and minimizing waste production.

LDEQ involvement includes evaluation of system effectiveness, recommendations for improvement, appraisal and approval of alternative measures, onsite inspection and observation, and cooperative involvement in planning and implementation of new technologies.

Diagenesis of the Carrizo Sandstone at Butler Salt Dome, East Texas Basin: Implications for Paleofluid-Flow

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The calcite- and pyrite-cemented Eocene Carrizo sandstone on the flank of Butler salt dome in East Texas was formed by processes similar to those that form calcite cap rocks throughout the Gulf Coast. Isotopic evidence indicates that the bacterial degradation of hydrocarbons combined with the venting of deep sour gas and the dissolution of anhydrite from the dome resulted in the precipitation of these cements. Identification of the origins of these cements has lead to a better understanding of the paleofluid-flow associated with the dome.

The Carrizo is a diagenetic quartz arenite with 42-50% concretionary calcite and pyrite cements. The calcite cement is bound to the northwest by a pyrite-cemented normal fault radial to the dome while the pyrite is found on both sides of the fault.

Calcite $\delta^{13}C$ (-18 to -37‰ (PDB)) and $\delta^{18}O$(-6 to -9‰ (PDB)) show a mixed source of both waters (meteoric and deep) and hydrocarbons (oil, gas, and lignite). Heavy pyrite $\delta^{34}S$ (12-15‰ (CDT)) represents H_2S supply from deep sour gas.

Deep waters, methane, and H_2S migrated up the dome flank and out the fault into the Carrizo, already containing oil and lignite, and pyrite precipitated along the fault and in adjacent sediments. Bacteria oxidized the hydrocarbons and, with the meteoric and formation waters, formed bicarbonate. Calcium-bearing fluids from the dome moved into the Carrizo, and calcite began to precipitate. However, pyrite cement along the fault prevented northwestern migration of the fluids, confining calcite precipitation to the southeast.