

Environmental Effects of Oil Production on Soil, Vegetation, and Surface and Ground Waters at the U. S. Geological Survey, Osage-Skiatook Petroleum Environmental Research Site, Osage County, Oklahoma.

Marvin M. Abbott, James K. Otton, Robert A. Zielinski, Bruce D. Smith, Yousif K. Kharaka, and James J. Thordsen

The U.S. Geological Survey is conducting multidisciplinary research into the transport, fate, and natural attenuation of inorganic salts, organic compounds, trace metals, and radionuclides present in produced water at the Osage-Skiatook Petroleum Environmental Research site, located on Skiatook Lake in Osage County, Oklahoma. Investigations have included geologic mapping; soil, bedrock, and ground-water geochemistry; water-level monitoring; borehole and surface geophysics; oak leaf biogeochemistry and tree ring dating; plant surveys; microbial population studies; and an aerial hyperspectral survey.

Petroleum production at the site began in 1913 and continued to about 1973. A salt scar and production-operation pits, seen on a 1936 aerial photograph, remained after oilfield operations ceased. Surface geophysics and soil and bedrock core extracts indicate higher concentrations of sodium chloride salt are present to depths as deep as 11.5 meters in the bedrock. The bedrock is composed of shale and sandstone. Oak trees adjacent to salt sources have greater chloride concentrations in the leaves than do trees located away from the salt sources. Repeated sampling of observation wells indicates a plume of high-salinity water (2000–30,000 milligrams per liter total dissolved solids) is present at depths below the mean level of Skiatook Lake. The plume extends laterally beyond the visibly effected surface areas. Results indicate only minor amounts of salt are removed by runoff. Salts still remain in the soil and bedrock of the effected area after more than 75 years of natural attenuation.