MBGS Meeting

September 13, 2006 (WEDNESDAY)

Coyote Creek
6951 Lansing Rd, Dimondale, MI.

Schedule: 5:30 to 6:15 PM Social Hour
6:15 PM Dinner
Presentation after dinner

Cost $25.00/member $15.00 Student (includes dinner)

Topic: "**Regression of Ethylbenzene/Xylenes Ratios for Estimating Release Date**"

By
Grant DeWitt

MBGS Dinner Meeting Reservation

Name_____

Number attending _____ Society_____

Enclosed Registration Fee _____

Please make checks payable to **MBGS** and return to Thomas Godbold by **September 11, 2006**. Members are welcome to attend the presentation after dinner for no charge. Please contact Thomas Godbold to ensure adequate seating. Send reservations to:

Thomas Godbold
P.O. Box 30256
Lansing, MI 48909-7756
Ph: Bus Ph: 517-242-2545, Fax 517-241-1595
E-mail:godboldt@michigan.gov

First-Order Exponential Regression of Ethylbenzene/Xylenes Ratios for Estimating Release Date

By Grant W. DeWitt, PM Environmental, Inc; and Dr.James S. Smith, Trillium, Inc

Abstract

A model is proposed to estimate a “petroleum hydrocarbon release or significant source reduction date range” (RDR) based on groundwater time series data exhibiting anaerobic, first-order exponential biodegradation decay. Groundwater monitoring data for sites with known release or source termination/reduction dates are compared with model predictions.

Gasoline, kerosene, diesel, and heating oil have composition ratios of ethylbenzene to xylenes of approximately 0.17 ± 0.05. Upon a release, typically aerobic bacteria rapidly use the available oxygen and drive the release environment anaerobic. Ethylbenzene and xylenes are C_2 benzene compounds that have nearly identical boiling points, vapor pressures, water solubilities, and carbon-water sorption coefficients. Therefore, the major fate and transport mechanisms of evaporation, water washing, groundwater velocity retardation, and dispersion treat ethylbenzene and xylenes alike. Anaerobic biodegradation will remove xylenes faster than ethylbenzene and the ratio of ethylbenzene to xylenes (EXR) in groundwater will increase with time.

Petroleum hydrocarbon biodegradation can be reasonably simulated using first-order exponential approximations. The ratios of these hydrocarbons will also follow first-order exponential approximations. Given the 1) difference in ethylbenzene and xylenes biodegradation rates and 2) similar fate and transport properties will not significantly effect the EXR differently over time, simulating the EXR using a first-order exponential approximation will eliminate the need to know the initial ethylbenzene and xylenes release concentrations and allow for modeling the observed groundwater data to predict a RDR using a minimum (0.17 - 0.05 = 0.12) and maximum (0.17 + 0.05 = 0.22) initial EXR representing a new release.

Ethylbenzene and xylenes groundwater monitoring data that exhibit anaerobic, first-order exponential biodegradation decay are used to estimate a RDR, or at least indicate the release could not have occurred after the estimated RDR, that were in reasonable agreement with known release and source reduction dates. The field examples suggest that regression analysis of post release data can be used or obtained to provide a reasonable estimate of the RDR, without the need for early time data. Historic EXR data are modeled and projected forward in time to support a new from old release determination. EXR data not showing an increasing trend and remaining near the range anticipated for a new release are associated with an example of intermittent free product conditions suggesting a means to indicate the continuing presence of free phase hydrocarbons and significant source material.

Biography

Grant W. DeWitt, BA, MS, PG, CP (professional geologist: Pennsylvania and Alabama and certified underground storage tank professional: Michigan) is a Senior Project Geologist at PM Environmental, Inc., an environmental consulting firm. Mr. DeWitt has managed numerous environmental site assessments, remedial investigations, underground storage tank (UST) closures, feasibility studies, and remediation system design including bioremediation, soil vapor extraction, and groundwater pumping pilot tests.

Specific project experience has included management of geophysical surveys, soil and groundwater sampling, free product recovery, bid specification development, and oversight of UST and soil removal. He has conducted Risk-Based Corrective Action evaluations, aquifer test analyses, groundwater flow and contaminant transport modeling, and water supply evaluations and provided expert opinion/witness for state and federal litigation.

He earned a M.S. degree in geophysics from the University of Utah in 1979 following a B.A. degree in geology from Temple University in 1975.

James S. Smith, PhD, CPC (certified professional chemist) is the president of Trillium, Inc., a consulting firm specializing in environmental chemistry. Founded in 1987, Trillium's areas of expertise are analytical chemistry, organic chemistry, inorganic chemistry, quality assurance and quality control, data validation, data interpretation, planning, sampling and analysis programs, environmental forensic investigations, and expert witness work.

Dr. Smith has published, presented and taught courses on environmental chemistry topics including analytical instrumentation such as mass spectrometry, analytical methods, fate and transport of petroleum and coal products and wastes, chlorinated solvents, PCBs, pesticides, herbicides, nematocides, dioxins, furans, polynuclear aromatic hydrocarbons (PAHs), metals, anions, detergents, plasticizers, paint, isocyanates, antioxidants, etc. in various environmental matrices.

He earned a Ph.D. in organic chemistry from Iowa State University in 1964 following BA degree in chemistry from Williams College in 1960.

Petrolia and Oil Springs Tour

North America's oil industry was born in 1858 when James Miller Williams built the first successful oil well on a deposit of "gum beds" located near the towns of Oil Springs and Petrolia, Ontario. The beds where first recognized in 1851, but neverdeveloped. Williams pumped 9,447 bbl of crude oil from his wells in his first two years. After which, he launched the first integrated oil company - exploring, drilling and refining the oil - with the founding of "The Canada Oil Company" in 1860.

For the next 50 years, these fields supplied 90% of the oil consumed in Canada and Petrolia became home to the world's most advanced oil development and refining technologies. The boom times were over by the turn of the 20th century, though commercial wells continue to pump. Thus far, the area has produced an estimated 10 billion barrels. As the Petrolia oil rush began to slow, the local drillers, who had learned how to get oil from the ground efficiently found their skills and methods in high demand. Petrolia oil men then dispersed around the world, to as many as 87 countries, opening some of today's great oil fields in the Middle East, Venezuela, and elsewhere