Column Tests to Assess Feasibility of Flushing Perchlorate from Soil

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Bench-scale treatability testing was conducted on soil and water (stabilized Lake Mead water) from an industrial facility located in the Las Vegas area of Nevada. Soil at the site is impacted with perchlorate due to historic operations. Laboratory testing evaluated the ability of added water to flush perchlorate from vadose soils into groundwater, where the perchlorate may be more easily treated. The effect of soil flushing on the removal of other constituents was also assessed. The soil flushing tests were conducted three soil samples which contained low (6.18 mg/kg), medium (145 mg/kg), and high (3,130 mg/kg) concentrations of perchlorate.

Laboratory column tests clearly demonstrated that flushing soil with approximately 2 pore volumes of clean water can remove perchlorate and other compounds from the site soils. For each column, most of the perchlorate detected in leachate was observed in the first 0.25 to 0.38 pore volumes collected (0.88 to 1.18 pore volumes added), though some perchlorate was detected in final leachate samples collected after application of 2.06 to 2.35 pore volumes of clean water. Greater than 99% of the perchlorate was removed from all three soils by the end of the study. However, in low-perchlorate soil, only 33% of the perchlorate could be accounted for in leachate, and in the medium-perchlorate soil only 62% could be accounted for in the leachate. In contrast, all of the perchlorate initially present in high-perchlorate soil could be accounted for in the leachate.

Arsenic and hexavalent chromium, Cr(VI), were detected in leachate from all of the columns, though the concentration varied among the columns. Leachate concentrations of arsenic after application of approximately 2 pore volumes of water ranged from 6.7 μg/L and 150 μg/L, while Cr(VI) leachate concentrations ranged from 5.2 μg/L to 120 μg/L. Most detected anions and metals behaved in a manner similar to perchlorate—that is, they increased within the first few leachate samples, then decreased in subsequent samples.

Presenter Biography

Cindy Schreier, Ph.D. Dr. Schreier has over 20 years of experience in chemistry and environmental science. In 1998 she founded PRIMA Environmental, an independent laboratory specializing in treatability testing, technology evaluations and custom laboratory work. Dr. Schreier has broad knowledge of both organic and inorganic contaminants as well as many remediation technologies. She has designed, conducted,

and evaluated hundreds of treatability studies to evaluate the effectiveness of these technologies and assess their effect on secondary water quality. Dr. Schreier received her Ph.D. in Civil and Environmental Engineering from Stanford University and her Bachelor of Science degree in chemistry from University of California Santa Cruz.

Author Biographies

Deni Chambers, P.G., C.E.G., C.Hg. Ms. Chambers is a certified hydrogeologist with over 20 years of experience. She is a specialist in assessing the requirements, feasibility, operation, and performance of remedial systems, including aggressive and innovative remediation technologies. Ms. Chambers draws upon a diverse academic background and experience in hydrogeologic and geologic investigations, computer modeling, chemical fate and transport, soil-water interaction, soil behavior, and engineering geology to manage a variety of hydrogeologic investigations and remediation programs. Ms. Chambers received both her Master of Science in civil and environmental engineering and her Bachelor of Arts in Geology from University of California Berkeley.

Mark Gage, P.E. Mr. Gage has more than 28 years of experience in chemical, environmental, and process engineering. His work has included process and plant design, construction, operations and maintenance, process control and instrumentation, materials science and computer applications. He has managed multi-million dollar projects involving cross-country and urban pipelines, municipal supply wells, water treatment systems, and municipal distribution systems. Mr. Gage has a Bachelor of Science degree in chemical engineering from the University of Michigan and a Bachelor of Science in computer science from California State University Hayward.