Environmental Anayltical Issues

Using the Bioaccessibility of Arsenic in Soil as a Risk Assessment Tool at Arsenic Impacted Railroad Sites

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Arsenic is a well-known constituent of concern at railroad sites nationwide. Recognized background concentrations vary significantly from region to region. Understanding contaminate sources and receptor implications play an important role during site characterization, the process of risk assessment, and remedial action plan development. Historically, multiple sources of arsenic are associated with railroad sites, including arsenic based herbicides and pesticides, rail tie wood preservatives, and sources from coal combustion processes. Each source of arsenic can cause the arsenic to behave differently in the soil, from impacting leaching characteristics, to how the human body can digest the arsenic. The in vitro bioaccessibility (IVBA) of arsenic in soil, which is a ratio of how much arsenic in a soil can be digested by the human body to total arsenic in the soil, has been extensively researched over the past 25 years and evidence shows that the bioaccessibility correlates to the source of the arsenic. Understanding the potential sources of arsenic in soil, and what fraction of IVBA arsenic at railroad sites, can help guide investigation efforts and ultimately give a better understanding of overall risk which can assist with the development of a remedial action plan.

Direct contact of arsenic in soil is a primary pathway of concern when evaluating risks of arsenic at rail sites. During site investigations, total arsenic in soil is measured and then typically compared against state or federal clean up criteria, which is used to assess risk and drive remedial goals. However, not all arsenic found in the soil is available for digestion and uptake by human and ecological receptors. By measuring IVBA arsenic, along with the total arsenic concentrations, a better understanding of how the arsenic is impacting human receptors is achieved. The typical bioaccessibility of arsenic in soil can range from 30-75%, but can drop as low as 5-10% from coal sources, for instance. More recently, state and federal programs are recognizing the importance of establishing site specific cleanup criteria developed using risk assessment tools such as the bioaccessibility of metals in soil. Measuring IVBA arsenic can be used as line of evidence to show that the arsenic at a site poses a lesser risk and can drive the creation of site specific cleanup criteria that is protective of human health and the environment, while increasing the sustainability of remediation decision making. For example, by demonstrating that concentrations of arsenic above a generic cleanup level are not bioaccessible, the carbon footprint for remediation projects can be significantly reduced, as arsenic is typically remediated by excavation and off-site disposal. Historical arsenic data collected at CN surplus property sites located in Mississippi will be discussed and then compared to new data collected in the spring of 2016."