Bioremediation and Sustainable Environmental Technologies—2017. Fourth International Symposium on Bioremediation and Sustainable Environmental Technologies (Miami, FL; May 2017). ©2017 Battelle Memorial Institute, Columbus, OH, www.battelle.org/biosymp. A. Barton and S. Rosansky (Chairs)

PAH Bioavailability Studies of Skeet-Impacted Soils

Robert D. George, Kara Sorensen, Anna Obraztsova (SPAWAR Systems Center Pacific, San Diego, CA, USA)
Jason M. Conder, Melissa Grover (GeoSyntec Consultants, Huntington Beach, CA, USA)

Background/Objectives. In recent years, we have been evaluating the historic use of polycyclic aromatic hydrocarbon (PAH) containing clay targets at Navy/Marine skeet ranges for purposes of exposure characterization and risk assessment, with a focus on PAH composition, soil-skeet partitioning, and bioavailability associated with incidental digestion of such soils. Relative bioavailability (RBA) is a frequently used risk characterization approach that is indicative of how much PAH is available to an organism divided by how much PAH can be extracted using organic solvent(s) via conventional analytical extraction methodologies. In the absence of digestive bioavailability or uptake information, the RBA value is typically assigned a value of 1, which can be overly conservative by up to an order of magnitude in many cases. The conventional approach consists of feeding trials using site-specific PAH-contaminated soils to ascertain the uptake of PAHs by the organism itself. However, such an approach is cost and time-prohibitive, resulting in a need for development of better tools and methodologies that provide a faster and cheaper means to characterize the biological uptake of PAHs from soils. A central goal of our efforts is to explore strategies to more efficiently determine an accurate RBA value for skeet and PAH-associated soils at these ranges.

Approach/Activities. Our efforts have been focused on evaluating two approaches that can be used to characterize the PAH bioavailability, a Physiologically Based Extraction Test (PBET) that extract PAHs from soil using a simulated digestive matrix, and a commercially-available polyethylene passive sampling device (PSD) that determines freely-dissolved PAHs in soil.

Results/Lessons Learned. PBET and passive sampling approaches were developed, optimized and evaluated for soils contaminated with PAHs. Preliminary results indicate that soil-associated PAHs are much less available than soils spiked with petroleum- and solvent-borne PAHs, respectively. The PBET and PSD results from skeet-PAH soils have also been compared on the basis of benzo(a)pyrene with results of dose-response and RBA estimates from feeding trials using those same soils. The use of these tools appears to be a valuable approach for purposes of determining bioavailability of PAHs in soils for accurate RBA estimation and risk characterization. We are currently evaluating a broader suite of PAH-impacted soils to assist in the development of a robust empirical model for correlating RBA estimates from PBET and PSDs with RBA estimates from feeding trials.