Matthew J. Mayo, M.S., GISP, CPG, P.G.
Jeffrey T. Rominger, Ph.D.
Neal C. Grasso, P.G., FTI Consulting

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A1. Innovative Characterization and Assessment Approaches
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Where Science and Cost Apportionment Collide: Contaminant Loading from Upland Soils to Sediments

Background/Objectives. Quantifying the diffuse loading of contaminants of concern (COCs) from soil runoff at upland sites to waterway and/or marsh sediments poses a significant challenge due to several uncertainties inherent in the calculations used for this purpose. Determining the diffuse upland loading of COCs to sediments can be an important component of apportioning remedial costs to potentially responsibly parties (PRPs) at sediment cleanup sites. It can also be a key part of determining the significance of different COC transport pathways in such contexts. However, scientists tasked with evaluating the mass of a contaminant that may be currently leaving, or could have historically left, a site must have an understanding of (1) a site's features and changes to them through the time, (2) the locations of and relationships between contaminant discharge pathways, (3) the availability and spatial distribution of sampling data, (4) the physico-chemical characteristics of relevant COC(s), and (5) the differences between upland soil cleanup levels and remediation goals and the cleanup requirements and goals associated with the endpoint sediments.

Scientists must also weigh the benefits and costs of the level of quantification and/or modeling required to meet the needs of a particular project and choose the appropriate quantification and/or modeling approach (*e.g.*, numerical or empirically based modeling, relative ranking). This allows those responsible for making remedial design decisions, as well as those responsible for allocating cleanup costs to PRPs, the ability to objectively rely on these data. As such, scientists must assess the accuracy and representativeness of their analyses' results against a project's sediment cleanup goals, based on several possible uncertainties in the gathered information. These uncertainties include (1) upland soil conditions at each site, (2) the reliability of the available analytical data from upland site(s), and (3) the quantification methodology(ies) employed to evaluate COC loading from upland soils to sediments.

Approach/Activities. There are several approaches to quantifying diffuse upland loading of COCs to sediments. Here, we present an evaluation of different methods based on modeling programs (*e.g.*, RUSLE2, WEPP, PWC). These methods have been applied at sites where operations that have resulted in COC impacts to sediments have occurred over several decades. We will summarize (1) the different input parameters required for these models and how they are derived; (2) the different assumptions inherent in each model; (3) the uncertainties observed when developing each model, as well as the process through which the uncertainties are managed and the accuracy of the results is assessed; and (4) how these results can be illustrative when allocating remedial costs to PRPs at sediment cleanup sites.

Results/Lessons Learned. While there are several methods of deriving diffuse upland loading of COCs, including those highlighted here, these methods are subject to uncertainties related to input parameters and the assumptions specific to each model. Depending on the specific needs of a project, the methods evaluated here provide some insight into how scientist can deploy different modeling programs to derive estimates of diffuse upland loading of COCs to help inform decisions ranging from evaluating cleanup goals to determining how to allocate costs to multiple PRPs responsible for the remediation of contaminated sediments as a result of upland soil loading of COCs (from PRP sites) to sediments.