A GIS Application for Developing Biological Sampling Designs and Estimating Resources Necessary for Implementation

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A large-scale release of a biological or radiological (BR) agent can result in contamination of a wide area and would require significant time and resources for recovery. Many unknowns are associated with characterization and clearance sampling during response to a wide-area (including indoor, outdoor, and underground areas) BR incident. The BR agent and its characteristics, the release mechanism, amount of contaminant released, and a plethora of environmental and meteorological factors are separate, yet interconnected processes that greatly influence the extent and level of contamination. Similarly, decisions related to the sampling strategy (i.e., sampling media, sampling area, spacing, etc.) will affect the cost, time, amount of waste generated, and personnel (i.e., resource demand) required to characterize and clear the contaminated area. A systems approach can be used to understand how these elements influence one another and contribute to effectively solving the problem. However, to what degree sampling and cleanup, more specifically, variations in these strategies interact and contribute to overall resource demand, following a wide area BR incident, is still largely unknown.

To better understand the impacts sampling designs can have on resource demand, especially when considering large-scale sampling campaigns, EPA's Homeland Security Research Program (HSRP) developed the Trade-Off Tool for Sampling (TOTS). TOTS is a GIS-based tool for developing sampling designs within ESRI's ArcMap and estimating the associated resource demand. TOTS consists of a point-and-click interface for importing externally-developed sampling plans or for developing plans by plotting sample locations using aerial imagery or computer aided design (CAD) drawings as a reference. From the developed sampling plans, the tool estimates the total time and cost necessary for implementation, which includes sampling kit preparation, sampling campaign, and lab analysis. The resulting sampling plan can be used to consider trade-offs in one's sampling design (i.e., cost-benefit analysis), alternate sampling approaches (i.e., traditional vs innovative sampling methods), and sampling coverage. Furthermore, the sampling design can be directly imported into ESRI's Collector and Survey123 applications for use in acquiring sampling data in the field. This presentation will provide an overview of TOTS, a case study featuring its use in the Bio-Response Operational Testing and Evaluation (BOTE) project, and future enhancements.