Development of ASTM Guidance on Application of Molecular Biological Tools to Assess Biological Processes at Contaminated Sites

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Background/Objectives. As remediation sites increase in complexity, the need for accurate characterization of a site's conditions as to its physical, chemical and biological nature also increases. The monitoring and evaluation of remediation also requires a complete understanding of attenuation processes. The application of physical and chemical testing procedures, such as slug testing and collection of water or soil samples, is widely understood and performed. However, evaluations targeting biological processes are much less commonly performed. As a result, most conceptual site models are incomplete. The purpose of the newly published ASTM Standard Guide is to provide a detailed overview of molecular biological tools (MBTs) and presents a framework through which project managers and other remediation professionals can select and apply MBTs at their sites. This is the first, comprehensive guidance document on MBTs produced specifically for site stakeholders.

Approach/Activities. A team of approximately 15 bioremediation professionals met monthly over a period of a year and a half to develop the MBT Standard Guide. Contributors included internationally recognized experts on the topic of using MBTs as part of environmental remediation. Meetings were held virtually during the coronavirus pandemic.

The document addresses both commonly used MBTs as well as recently introduced technologies, and targets questions that might need to be answered at different stages of a project's lifecycle. There are illustrations and tables to guide the reader through the application of tools. One table lists commercially available MBTs, the type of data that each tool generates, and provides the advantages and disadvantages of each tool. Another table, which is five pages in length, is a comprehensive list of gene targets for functional genes and microorganisms involved in contaminant degradation. Sample collection considerations are presented in yet another table. The text guides the user through the life cycle of a project, including the selection of an MBT, development of a sampling plan, and the interpretation of data. Discussions about the importance of properly integrating MBTs into a project plan as part of a multi-layer of evidence approach are also included.

Results/Lessons Learned. The ASTM process requires that a standard be balloted, or voted upon, at two levels, the smaller subcommittee level and then by the larger main committee. Standards are approved by a consensus process, which means that if any negative votes, or objections, are received, they must be satisfactorily resolved in the eyes of the objector before

the standard can be published. The ASTM Standard Guidance on Application of Molecular Biological Tools was approved on the first ballot at both levels of voting. Some of the comments received stated that “this guidance fills a big need in the remediation community”. The team plans a robust technology transfer program that will include webinars and workshops.