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**APPLYING IMPROVED STATISTICAL METHODS
DURING SITE INVESTIGATIONS AND RISK ASSESSMENTS
TO REDUCE DECISION ERRORS AND SAVE MONEY**

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May 1, 2002

Statisticians and regulators have known for a long time that the methods commonly used for collecting and evaluating site data, which have been codified in existing guidance, do not perform as intended. Despite being designed to assure adequate protection of public health and the environment, the frequency with which contaminated sites are falsely determined to be clean appears to be greater than expected based on theory. As important, such methods also falsely indicate the need for cleanup at far greater rates than other procedures that may also be employed to evaluate and interpret data from hazardous waste sites.

In a series of papers, coworkers and I have helped to elucidate such problems and device improved procedures to circumvent them:

- Berman, D.W. "Addressing Data Quality Issues Throughout the Site Characterization Process to Minimize Decision Errors," in *The First International Symposium on Integrated technical Approaches to Site Characterization*, Proceedings of an Argonne National Laboratory Conference on Expedited Site Characterization, Chicago, Illinois, pp. 13-29, 1998.
- Berman, D.W.; Allen, B.C.; and Van Landingham, C.B. "Evaluation of the Performance of Statistical Tests Used in Making Cleanup Decisions at Superfund Sites. Part 1: Choosing an Appropriate Statistical Test." *Superfund Risk Assessment in Soil Contamination Studies: Third Volume, ASTM STP 1338*, K.B. Hoddinott, Ed., American Society for Testing and Materials. Pp. 99-114, 1998.
- Berman, D.W.; Allen, B.C.; and Van Landingham, C.B. "Evaluation of the Performance of Statistical Tests Used in Making Cleanup Decisions at Superfund Sites. Part 2: Real World Implications of Using Various Decision Rules" *Superfund Risk Assessment in Soil Contamination Studies: Third Volume, ASTM STP 1338*, K.B. Hoddinott, Ed., American Society for Testing and Materials. Pp 115-130, 1998.

- Berman, D.W. "Does Risk Assessment Work? (Limitations Imposed on Risk Assessment by Data Quality and Common Practices)" in Challenges and Innovations in the Management of Hazardous Waste, Proceedings of an Air & Waste Management Association and Waste Policy Institute Conference, Pittsburgh, Pennsylvania. pp. 493-503, 1995.

We are now applying these methods at various sites with good results. Moreover, regulators have found these methods to be acceptable alternatives to current practice. In fact, various agencies are exploring similar alternatives to be incorporated in future versions of guidance. But few contractors are currently aware of them or know how to apply them.

Because the improved methods are no more expensive than traditional approaches, reductions in cleanup requirements translate directly into savings on project costs. Applications include (but are not limited to) such things as:

- design and implementation of cost-efficient yet highly effective field studies that reduce the chance that non-problems will falsely be declared to be problems so that money and resources are not wasted on unnecessary remediation;
- improved evaluation of remediation needs to better focus and reduce remediation requirements; and
- improved sampling, analysis, and evaluation to support waste classification for disposal that reduce cost either by reducing the chance that waste is falsely classified as hazardous or by reducing the volume of waste classified as hazardous.