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TITLE QUALITY ASSURANCE OF FIELD SCREENING

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QUALITY ASSURANCE OF FIELD SCREENING

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ABSTRACT

As the costs of collecting, shipping, and analyzing samples for environmental compliance have increased, ways of reducing those costs have been pursued, including field screening methods. Field personnel have long wanted methods that are portable, easy to use, sensitive for all regulated compounds and elements, and approved for use by all regulators. However, field methods do not currently meet these needs, and thus data quality for these methods must be established. The proper amount of quality assurance on field screening methods cannot be easily standardized or prescribed for all field screening. Many field methods have not been documented sufficiently. To ensure that data of known quality is produced from field methods, the significant aspects of the operation of that method, including performance, must be determined and documented. The DOE's Laboratory Management Branch (EM-532) has initiated a program to assess the numbers and types of field methods both in the literature and available commercially.

INTRODUCTION

Environmental regulations aimed at characterizing and remediating contaminated sites rely heavily on analytical chemistry data to determine the presence and extent of contamination. This heavy reliance on extensive chemical data has become very costly. In addition, field operations personnel have found that the long turnaround time for data has a negative impact on those field operations. For a cleanup activity, for example, personnel and equipment must be decontaminated and moved to other operations pending laboratory data (which sometimes takes weeks) to determine if the site has been sufficiently remediated.

Consequently, as the cost of collecting, shipping, and analyzing tremendous numbers of samples has increased, ways of reducing those costs have been pursued, including field screening methods. Field operations personnel have long wanted field methods and instrumentation that are portable, easy to use, sensitive for all regulated compounds and elements, and approved for use by all regulators. (In essence, what is wanted is the famous tricorder from the old Star Trek television show.) However, since no field screening instrumentation currently available today offers those characteristics, field operations personnel have to settle with less capable equipment. The use of field screening methods that are not perfect requires that the appropriate level of quality assurance (QA) is provided.

DISCUSSION

Regulatory Drivers

No environmental regulation prohibits the use of field methods. However, the goal of the Environmental Protection Agency's Quality Assurance program is to ensure that all methods be scientifically valid, defensible, and of known precision and accuracy. The data must be of sufficient known quality to withstand scientific and legal challenge relative to the use for which the data are obtained [1].

Cost Drivers

Many current approaches to site or waste characterization and cleanup use directed sampling, statistical sampling, or iterative approaches. A common thread throughout all of these approaches is the use of field methods to both direct sampling and to reduce the number of samples and analyses that are sent to off-site laboratories. Use of these field methods can result in tremendous cost savings. For example, if only a 10% reduction in costs can be assumed from use of field methods, the EPA Superfund work could save approximately $6 million, and the future DOE cleanup effort could save substantially more per year. However, data produced by all methods, including field and laboratory methods, must be of known quality to be valid. Therefore, the proper application of quality assurance and quality control (QC) measures on field methods is essential. The need for quality assurance and quality control on field methods has never been questioned; the determination of the proper level of QA and QC, however, has been the subject of much debate.

Determination of Appropriate QA Levels

The appropriate level of quality assurance on field screening is not something that can be decided for all field screening situations. The proper amount of quality assurance depends greatly on two major factors: the type of field method used and the final use of the data.

The choice of field method(s) must be appropriate to the question. If the field person is interested in finding "hot spots" (areas of contamination), then the field method chosen does not require demonstrated performance in the determination of the targeted contaminant at regulatory levels. Rather, the method needs only to indicate where sampling must be conducted and more rigorous chemical analysis methods should be used. For this situation, rigorous quality assurance measures need not be applied, the only recommendation being that the user determine, before use, that the field method is performing properly. A higher level of quality assurance is needed for field methods designed to prove a negative result. In this scenario, the user believes that no significant contamination exists, or that a site has been sufficiently cleaned up. For example, a portable gas chromatograph with a flame ionization detector is not an appropriate field method to determine that no targeted volatile organics contaminate a site. The flame ionization detector does not have the requisite sensitivity. Extensive quality assurance would not solve this problem. However, the use of a transportable gas chromatograph/mass spectrometer would be an appropriate choice for this example. This instrumentation, using a purge and trap sample introduction system, has sufficient sensitivity. Then the level of quality assurance that must be applied should be comparable to the similar laboratory method.

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[1] "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846, U.S. Environmental Protection Agency, 3rd Edition, 1987.

Many feel that field screening methods require little or no quality assurance since the numbers that will be generated will be approximate. This approach is appropriate if the data will be used in that manner. More often the problem is not that the QA is inadequate, it is that the data user is trying to draw more conclusions from the data than is warranted.

The drawback of requiring significant quality assurance on field methods is twofold: the first problem will be that the amount of QA will give the data user a false sense of security regarding the data and the second problem is the additional cost of QA.

Current Approaches

Currently, the operation and performance of many field methods have not been documented sufficiently. To ensure that data of known quality is produced from field methods, the significant aspects of the operation of that method must be determined and documented. In addition, the performance of that method must also be determined and documented, often as compared to laboratory-based methods.

The DOE's Laboratory Management Branch (EM-532) has initiated a program to assess the numbers and types of field methods both in the literature and available commercially. Emphasis will be on technology that is relatively mature but not yet widely available. The assessment will be divided into two areas: radiochemical field screening technology and chemical field screening technology. The applicability of field screening methods to nonradiological constituents in radioactive materials will also be assessed. Instrumentation to be considered ranges from that which is person-portable to that suitable for field laboratories.

Much recent emphasis has been placed on the merits of field screening technology, and DOE needs information on what is available as well as an informed assessment of each method's capability, performance, and applicability.

Several recent surveys of field screening methods are available in the literature. These surveys are being obtained and reviewed within the context of DOE needs. In addition, the literature is being surveyed as needed. Relevant researchers are being contacted to identify immature technologies and methods that, with future funding, can bring new and potentially powerful methods to fruition. Subsequent work will involve field trials and technology transfer.

The assessment would benefit DOE in three areas. From the results of the assessment, DOE can 1) distribute the information to all sites for application, 2) make informed decisions regarding method development in deficient areas, 3) standardize on appropriate methods so data generated across the complex are reproducible, and 4) identify field screening methods that can provide considerable cost savings during the assessment phase of the DOE Environmental Restoration program.

Future Approaches

Additional issues that must be addressed include evidence requirements for field operations, field documentation, variation from established field procedures, and the increasing use of extensive computer codes for field data reduction.