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Preface

On-site analysis is becoming a practical and feasible method of dealing with environmental incidents. Increasingly, capability is being developed to move the laboratory in the field. This trend is not only taking place by the simple movement of the existing laboratory technology into the field, but by the development of new portable technologies, be they carried by people or by vehicles.

The benefits of having on-site analysis are many. The primary benefit is the reduced cost of cleanup. This is particularly true in cases where, for example, excavation is being conducted. If on-site analytical capability is used, only the contaminated material needs removal. This can save thousands of dollars in removal or treatment costs. If on-site capability is not there, the trend is to remove material until lab results confirm that the remaining soil is clean or enough has been removed to ensure that no contamination remains. Without on-site analysis, many tons of extra material can be removed. Removal and disposal costs of contaminated soil can be as much as $10,000 a ton. Cost benefits of on-site analysis are immediately apparent.

Another important benefit to on-site analysis is the significant improvement in time response. On a particular site, in which I worked a number of years ago, we had both an on-site capability and a laboratory system for monitoring PCB's (Polychlorinated biphenyls). The fastest turn around for the fixed laboratory was two days. The on-site unit resulted in a turn around of one hour. For three days all actions were verified using the fixed laboratory. Several workers and pieces of machinery were tied up and not working until the laboratory results were returned. After the first three days, machines or equipment suspected of contamination were wiped, samples analyzed on site and decisions made about returning the equipment to service or decontaminating it, made within hours.

Another form of cost advantage is the lesser expense of most on-site analysis. The cost of the analytical work itself is very different. The field unit often can do samples at much cheaper costs than the fixed laboratory unit. The field samples require less handling, shipping, storage and work ups. Furthermore, the field procedures often require the use of less consumables and much less time to process. Examples of this are the costs for the above PCB incident. Laboratory samples cost $250 each and field samples were estimated to cost $50 each.

There are, of course, several disadvantages to using field procedures. The biggest disadvantage is that many field procedures are not accepted in terms of standards such as set by EPA, NIOSH or ASTM (The Environmental Protection Agency, The National Institute for Occupational Health and Safety, The American Society for Testing and Materials). This means that controlled sites may not be able to use these procedures. Analysts may also not wish to use the procedures because of possible legal

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actions. Only standard procedures would stand up in court. It will take another decade before many on-site methods become certified as standard methods.

The second disadvantage of on-site methods relates to the reliability of measurements. Often field methods do not have the ability to build in checks such as the simultaneous analysis of surrogate standards. Often there are no quick or easy means to run a calibration standard. When this is the case, the reliability of field measures is questioned. Reliability of field measurements can be improved by building procedures that also include running standards between samples or other means of calibration.

What is the future of on-site analysis? There is no doubt that use of on-site analysis will increase and that the capability and reliability of on-site measurements will increase. The development that will most increase the on-site capability is the arrival of new sensors. It has been the development of new sensors and instrumental components that have driven the further evolution. The rapid increase in electronic capability and miniaturization has been a factor but has not been the major factor. Mechanical miniaturization is also a factor. Examples of this include the development of a GC on a chip – which has made air chromatography in the field a reality. The rediscovery and re-application of old wet chemistry methods will continue to drive the development of new test kits that employ classical chemical methods. The editor has been involved in on-site analysis for more than 15 years and is surprised by the slowness of development of on-site methods. The above factors leading to the acceleration of on-site method development have been offset by the smallness of the market and the reluctance of individuals to employ new and nonstandard methods.

The requirements for on-site analysis are first that the method is reliable. The method need not be highly accurate, but should never result in a false negative and rarely in a false positive. Large amounts of development and testing are required to ensure that this is the case with a particular method. Users must also clearly understand the limitations and interferences of any field methodology. Secondly, the field method must be rugged – irrespective if the technique involves a portable kit or a vehicle-mounted unit. The rigours of the field are often underestimated. Thirdly the field method must be easy to use especially for those hand-carried. The rigours of the field do not allow users to carry out complex and demanding procedures. Finally, the methods must have satisfactory accuracy. For field use, order-of-magnitude accuracy is generally sufficient. Users must also clearly understand the accuracy limits within the context of the samples they are analysing.

Field analytical techniques are being developed at a moderate pace. The predictions that fixed laboratories would become 'dinosaurs' and that field testing would be the 'mode' have not been correct and will not be for a long time, perhaps never. The role for both will always be present. Field tests continue to focus on giving more qualitative answers than do laboratory tests. Field tests still require some laboratory tests as confirmation.

This issue of the Journal of Hazardous Materials highlights a number of developments in field analysis. Hopefully, this issue will also promote communication among developers and users of this new technology.

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