AEL environment

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# Technology and On-Site Testing:

## Advances in Environmental Site Assessment Approaches and Practices

# Part 1 PROVINCIAL REQUIREMENTS

## New Requirements Promote On-Site Screening

**For environmental professionals and stakeholders, the risk-based clean up requirements for soil and groundwater (embedded in the current CCME and provincial regulations) promotes, and in some cases requires, intensification in the use of on-site screening of soil quality.** Improvements in technology and on-site testing approaches provide environmental professionals with an opportunity to meet these requirements at lower cost while at the same time greatly improving the understanding of a site by using the on-site test results to guide the investigation.

For example, the current requirements under Ontario Regulation 153 for evaluating the quality of stockpiled fill mandates the use of field screening data to laboratory data at a ratio of 5:1 respectively with a minimum requirement of one screening sample every 10-20 cubic metres. Furthermore, the current EBR version of the Ontario MOE document "Soil Management – A Guide for Best Management Practices" extends some of the same sampling approaches included in O.Reg. 153 in the transfer of excess soil fill material between sites. This mandated requirement for increased quantity of field screening data should also raise corresponding questions regarding data quality and its use so that the field program best supports the definitive laboratory testing.

Several key elements are required to ensure that field screening data not only supports laboratory testing but also provides the assessor with an ability to further question laboratory results or sample handing protocols when the two don't match.

The use of combustible gas metres in the screening of soil and groundwater samples is well established in the environmental assessment industry. Pioneered by the retail gasoline sector, combustible gas metres were instrumental in allowing assessors to adequately screen soil and focus in on areas requiring attention. There use has become imbedded in regulation and standardized approaches across the industry. At the same time the technology has shortcomings. It does not always correlate well with higher carbon chain fuel products like weathered diesel, is inadequate in the assessment of compounds like Bunker C oil or poly aromatic hydrocarbons (PAH) and is, for obvious reasons, unable to assess comingled metals such as lead in gasoline. These technology "gaps" are even more apparent if the investigation is focused on elemental metal impacts or other non-volatile contaminants of concern site impacts related to industrial land use.

# Part 2 TECHNOLOGY AND IMPLEMENTATION

## Using Site-Specific Approaches to Screening Plans

Since a "one size fits all" approach is not effective, a number of compound-specific site screening tools have been developed to support an integrated approach to site assessment. Just as combustible gas metres interact with evaporation of volatile compounds to provide non-compound specific indications of contamination, other site screening tools interact with different physical and chemical properties of contaminates to provide non-speciated [and in some instances compound specific] indications of contamination. In general, screening of organic compounds provides non-speciated quantitative results that rely on physical or chemical properties of groups of compounds in response to stimulus. Just as combustible gas readings provide non chemical specific results for volatile compounds like benzene or TCE, other organic site screening tools rely on properties like ultraviolet fluorescence and immunoassay responses to further quantify and detect potential contaminates. In the case of inorganic elemental metals, speciated results are readily obtained, generally at detection limits below regulatory action levels, through the use of x-ray fluorescence (XRF).

Non-speciated analysis, and non-conforming speciated analytical approaches like XRF, are beneficial for inclusion in site assessment work because they provide real time results, lower analysis cost and high sample throughput. At the same time, they can be problematic in their interpretation without a comprehensive approach to evaluating the results. Some of these issues have been addressed by two research initiatives by the US EPA and by the development of standardized methods.

In addressing the need for independent verification of site screening tools the US EPA developed the Superfund Innovative Technology Evaluation (SITE) forum whose mandate was to "provide performance verification of innovative environmental sampling, monitoring and measurement technologies" through a duplicate side by side blind test of related technologies benchmarked to certified laboratory test results. With a respected independent third party evaluator like the US EPA, the site assessor can assess the relative merits and limitations of a technology independent of vendor bias. The program provided good correlation support for technologies based on Ultraviolet Fluorescence [in the analysis of Total Petroleum Hydrocarbons] and XRF [for metals] demonstrated through this program, expanding the range of potential contaminates that can be reliably screened on-site. In the case of XRF the US EPA provided further support for the technology with the development of a standard method for the use of XRF analysis in determining elemental concentrations in soil and sediment on-site.

This combination of technology evaluation and standardized implementation is key in the production of reliable on-site screening of soils. However, the rate of technology advancement soon outstrips the capacity of an institution to review and benchmark results as reflected by the fact that the last SITE forum publication was released in 2008. As a result a standardized approach is required to be able to gain reliable and reproducible on-site screening results. One way this is addressed is with the implementation of a Triad Approach, another US EPA initiative, which provides a standardized framework that integrate the triad of (1) dynamic work plan strategies, (2) real time measurement technologies and (3) systematic project planning to "help streamline assessment and cleanup activities at brownfields sites".

# Part 3 PUTTING THE TECHNOLOGY TO BEST USE

## Choosing Best Tools and Practices for Common Challenges On-Site

One of the standardized framework tools developed under the Triad program is the use of investigative limits correlating laboratory results with field screening analyses. Using this approach over time provides a range of compound-specific upper and lower investigative limits to be developed to prioritize samples with a higher risk of false positive or negative results, as compared to certified laboratory analyses. By using this approach in conjunction with regulatory limits, the assessor can focus work in real time on those areas where further delineation may be required, supported by the certified laboratory results, without being restricted by the normal time constraints imposed by waiting for lab results. This constant iteration improves the reliability of the site screening method and develops a database of sampling results that can be extrapolated to new sites where correlation data may not exist.

Another useful Triad based approach is the use of subsample on-site analysis to identify and address potential sample heterogeneity issues. Using this approach, smaller subsets of a sample are analyzed on site as a means of determining the homogeneity of the sample. Based on these results the assessor can select a subset for laboratory analysis (generally the higher field values) and improve the overall correlation of the field testing with the certified laboratory results. Decreased technology analyses time, while maintaining or lowering detection limits, now make this a practical approach for use in screening on-site soils for elemental metals.

Improved technology, either in method development or in sensor detection limits, increase the reliability of field screening techniques. As mentioned, XRF detection limits for most elemental metals listed as priority contaminants are now well below action levels with sample through put that can readily accommodate the analysis of 50-100 samples per day. When used appropriately by the assessor this becomes a powerful tool in developing an understanding of the site and refining the conceptual site model.

Direct coupling of on-site soil and groundwater analysis with direct push sampling equipment can also greatly increase the availability of screening data for a site. At the most basic level existing sampling approaches (either direct push, conventional or even test pitting) can be combined with on-site testing to provide the assessor with real time data during a sampling program. More detailed site information can be collected through direct push probes calibrated to collect soil stratigraphy, groundwater and/or free product plumes, as well as soil gas levels. This real time data can then be used by the assessor to refine or add sampling locations while abandoning other locations determined to be not as critical to the investigation. By refining the conceptual site model in real time a more robust risk profile of the site can be developed by collecting more detailed information where required and clearly delineating those areas from less impacted parts of the site. This improves site understanding at a lower overall cost since repeat visits to the site are less likely, and gives greater confidence in managing risk and liability.