Benefits of New Site Characterization Techniques

For those involved in environmental site assessments, **new site characterization techniques** such as high resolution site characterization (including field measurement techniques like **Portable X-Ray Fluorescence**), improve data management and real-time data visualization. They provide benefits such as:

- Rapid collection of large amounts of data
- Faster decisions that compress timelines and greatly decrease costs
- Better remediation designs due to improved conceptual site modeling based on statistically supported decisions

At a recent Federal Remediation Technologies Roundtable, Stephen Dyment of the US EPA Office of Superfund Remediation and Technology Innovation presented a case showing how using these new techniques led to an improved remediation design, **decreasing project cost from $200 million to $70 million.**

Evolving Understanding of Soil Characterization

Mr. Dyment explained the changing understanding of site characterization when it comes to contaminated soil:

"On the other side of the spectrum, again historically we've done discrete sampling for soil samples and I've got a couple pictures for you, so here you've got the typical size of soil sample about one or two grams. About the size of a penny, but when we make remediation decisions we are making them on the order of what you see there with the backhoe, typically acres and half acres. So we are taking these very small discrete samples in a highly heterogeneous matrix and then translating those results back to tons of soil."

Penny sized discrete analytical sample representing tons of soil on-site. Photo credit: Stephen Dyment

Mr. Dyment discussed the EPA's new thinking on soil sampling and on-site measurement:

"So we are very much focused on incremental sampling design and use of tools like X-Ray Fluorescence (XRF) for example. Real-time tools that we can manage this stuff in the field and we still typically collect some laboratory samples as well, but we're managing that with our direct sensing tools and our real time measurement technologies. That's really the way we're going to get around that."

Advantages of Rapid Data Collection

As you can see in the visualization, measuring a small portion of the soil used to represent large amounts of site material can only be expected to lead to sound decisions if the sample is representative of the group from which it is taken. Unfortunately, soil has been shown to demonstrate large, short, and micro scale heterogeneity.

Large-Scale Heterogeneity

The difference between contaminated volumes soil and uncontaminated volumes. Typically the kind of heterogeneity that site characterization is looking to identify in order to perform exposure assessments, remedial design, and demonstrate compliance with a regulatory action level.

Small-Scale Heterogeneity

Differences in concentration between samples spaced just a few inches or feet apart, can mislead decision-makers about the true large-scale heterogeneity of an area being assessed.

Micro-Scale Heterogeneity

This type of heterogeneity is the type seen within the same grab sample or sample jar. This can cause differences in analytical results between subsamples prepared for duplicate analysis at a laboratory.

Evolving understanding of the key sources of error in site characterization data has shown that the biggest error does not come from error in analytical lab work but in the density of data collected and from proper soil sampling design.

Experiment

XOS has introduced the HD Rocksand™, a next-generation field measurement technique for measuring heavy metals in soil, to enable rapid data collection on-site to improve site characterization and remediation solutions. Samples were collected across several sites contaminated by a variety of heavy metals at various concentrations and tested using the HD Rocksand, powered by HDXRF technology. The samples were then submitted for analysis by an independent third-party lab for ICP-MS.

Conclusion

Samples cover a variety of types of soil and sediment. The results of the study demonstrate that HD Rocksand's HDXRF and ICP-MS results correlate with each other very well for elements over a broad range, which means that one can use HDXRF as a equivalent tool of ICP-MS within a certain range.

For additional information about HD Rocksand, visit our website at **xos.com/hd-rocksand**. Free demonstrations are available in-person or via the web. To request a demo, visit **xos.com/contact** or call **1.518.880.1501**.

Sample	Cr		Ni		Cu		Zn		As	
	HDXRF	ICP-MS	HDXRF	ICP-MS	HDXRF	ICP-MS	HDXRF	ICP-MS	HDXRF	ICP-MS
1	89.15	85.2	41.75	38.3	53.85	51.5	84.1	80.1	18.8	18.0
2	63.6	58.2	30.5	26.4	31.3	29.5	97.95	86.7	20.4	17.8
3	146	102.0	76.8	69.3	139	114	182	152	123	120
4	119	89.4	51.5	46.5	122	104	198	176	11.9	11.0
5	109.5	87.3	32.85	28.9	185.5	170	291	255	668	697
6	66.1	54.8	32.4	27.9	24	22.2	73.3	61.3	12.2	13.4
7	62.4	44.7	21.7	18.0	20.1	16.4	73.7	62.0	28.5	27.6