

How a Lab Works

Demystifying the black box of Analytical Chemistry– From Field Sample to Final Result

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Overview

- Analytical process summary
- Metals in soil analytical process
- Organics in soil analytical process
- Result assumptions
- Key points to remember



How Many Environmental Consultants Think Labs Work

Samples → [Black Box Magic] → Results



Key Steps in the Analytical Laboratory Process

From Sample Arrival to Final Results



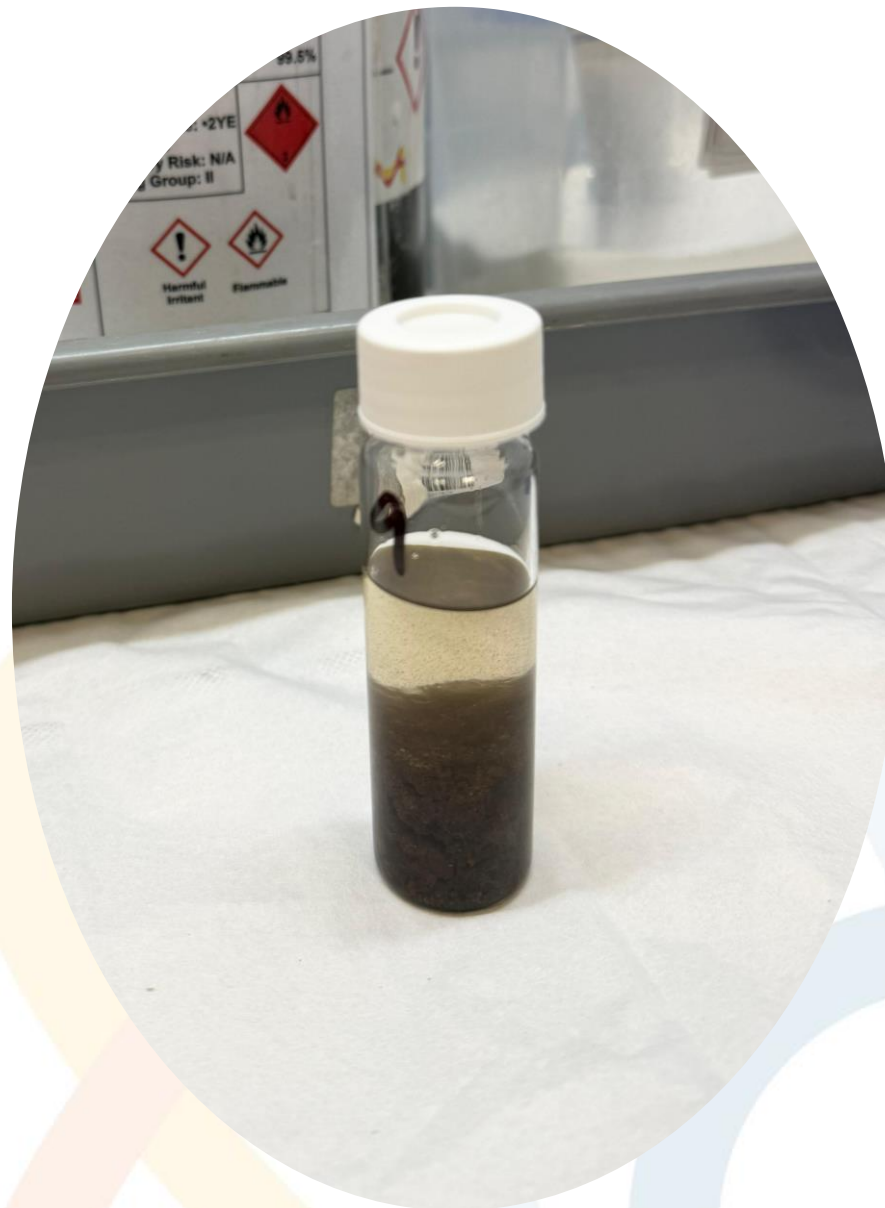
Metals Process

- Sub-sampling from container
- EPA 200.2 drying and sieving through 2mm sieve
- 1g taken for strong acid digestion
- ICPMS analysis



Organics Process

- Sub-sampling from container
- 10g extracted in solvent
- Extract clean-up
- GCMS analysis

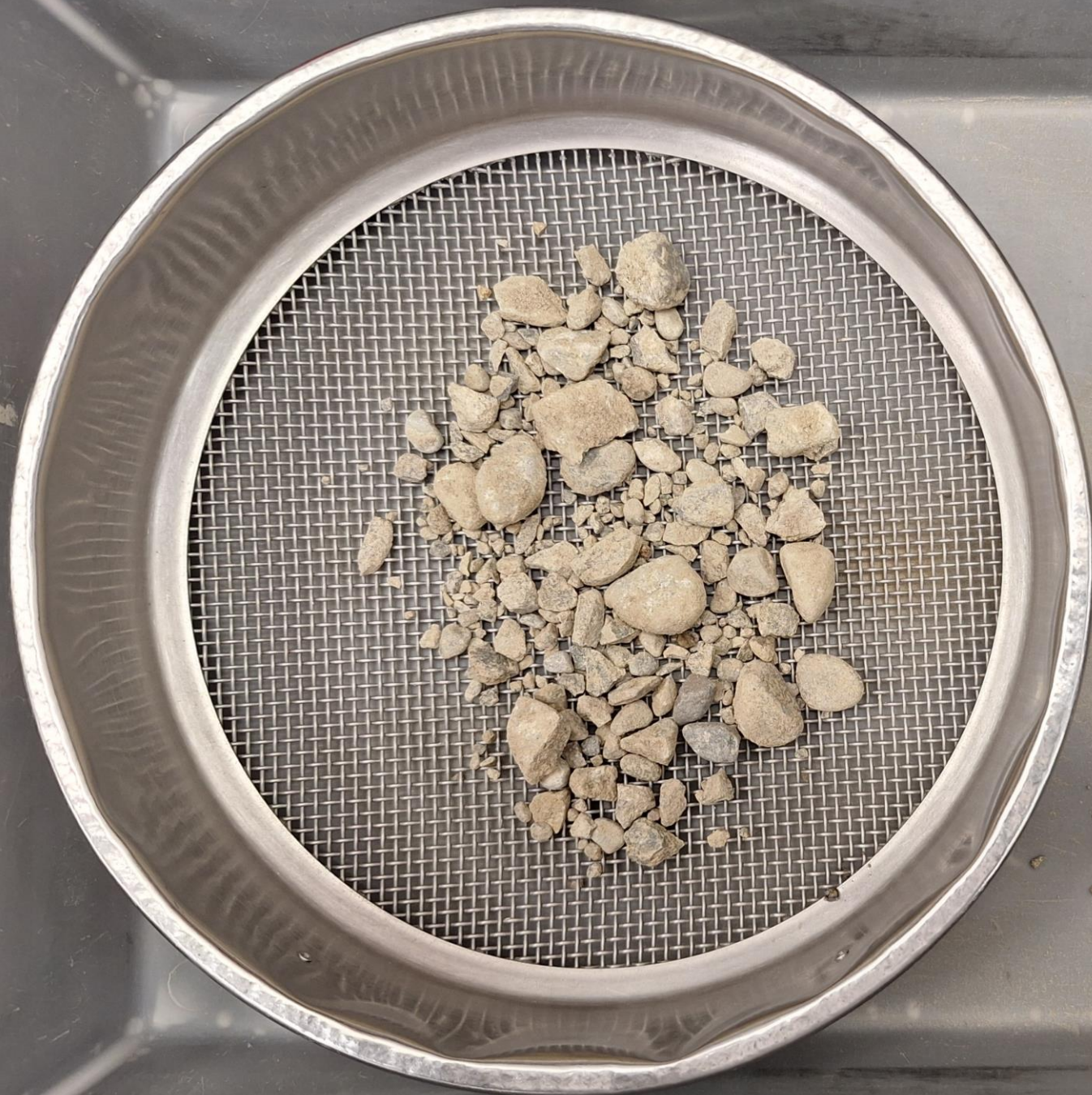


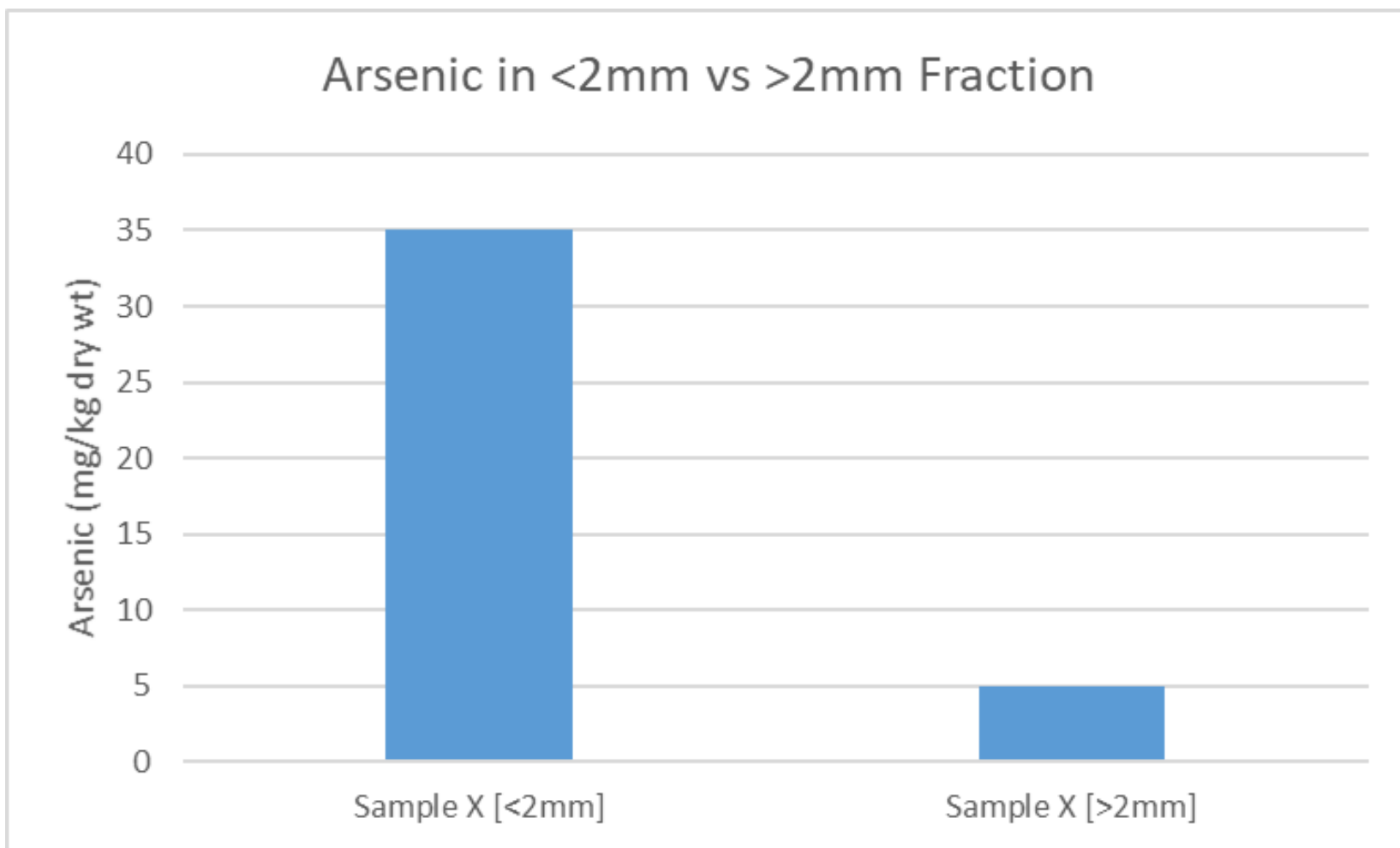
Assumptions

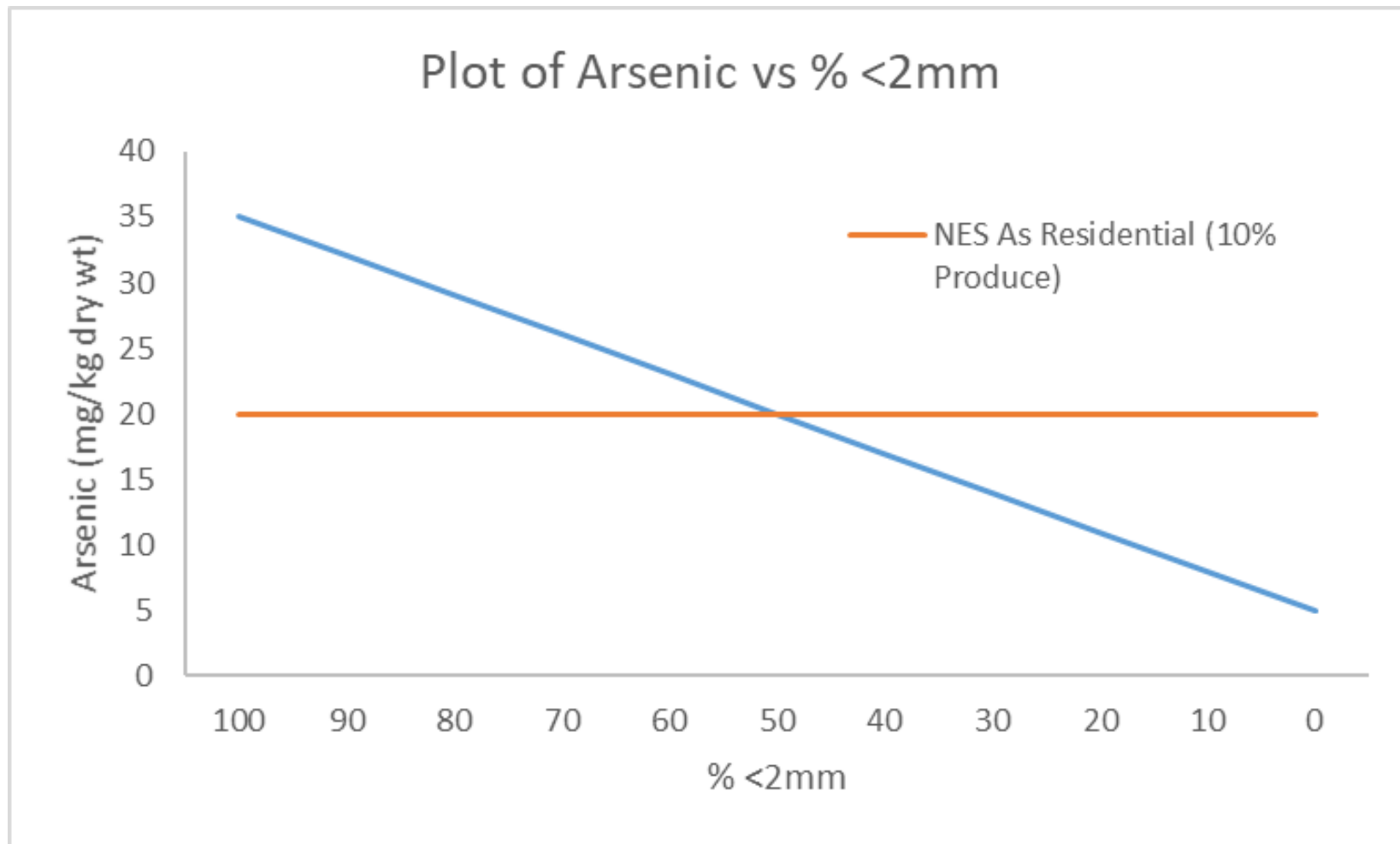
Arsenic = 28.3 mg/kg dry weight

- Entirely homogenous?
- Would we get exactly the same result if we analysed it ten times?
- The same in every size fraction?
- What disposal implications are there?









Bioavailability*

- NES assumes 100% relative bioavailability (RBA).
- Across most sites, arsenic RBA typically falls between ~20–50%, with very few results exceeding ~60%.
- This closely aligns with international studies and supports the US EPA conservative upper-bound assumption of 60% RBA for human health risk assessment.
- Applying a 60% RBA has some important implications, e.g. the NES-SCS residential arsenic standard would increase from 20 to ~30 mg/kg.
- Worthwhile considering bioavailability if it could help leave material in place.

Key Points To Remember

- A basic understanding of how the lab arrived at the result they gave you is very beneficial.
- “Analytical results are not concentrations but error-prone estimates of concentrations.”*
- Sub-sampling and sample preparation can significantly change the nature of the as received sample taken for analysis.
- Oversize material generally has lower levels of contaminants than fines.
- Consider spending a little more up front on determining fraction sizes and bioavailability if warranted.

*Analytical Methods Committee, Royal Society of Chemistry, AMC Technical Brief, No 5, April 2001