GOODSamples: Tools

Inspection and Sampling

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Important Elements of Sampling Theory

- Enough mass
- Enough increments
- Proper tools to ensure equiprobable selection of all the particles
- Maintain integrity of analyte from the field to the instrument

Sampling Tools

- What are the critical design elements? (equiprobable selection of all the particles)
  - reach all the particles
  - no discrimination based on size, shape, location, etc.
- Does the tool or use of the tool affect the analyte?
  - contamination of analyte
  - loss of analyte
  - physical form of analyte
- Use
  - safety
  - ability to decontaminate
  - easy to use
  - durable

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Purpose of Tools

- Select material from decision unit
- Access any random location within decision unit
- Equiprobable selection of particles at increment location
  - too fine to be collected
  - too large to fit into sampling tool
  - particles not reached by tool
  - particles fall out of tool when removed
  - particles stick to tool
  - incorrect increment geometry

is exclusion of the largest particles when the center of gravity rule is not obeyed. Simply stated, if the center of gravity of the particle is within the ideal increment shape it should be included as part of the increment. If the center of gravity of the particle is not within the ideal shape of the increment, it should not become part of the increment. This problem only occurs with loose particulate material. While this may seem like a complex idea, it is generally easy to avoid if the following rule is observed. The diameter of the opening in the sampling tool (thief, probe, etc) needs to be three times the diameter of the largest particle you wish to represent.

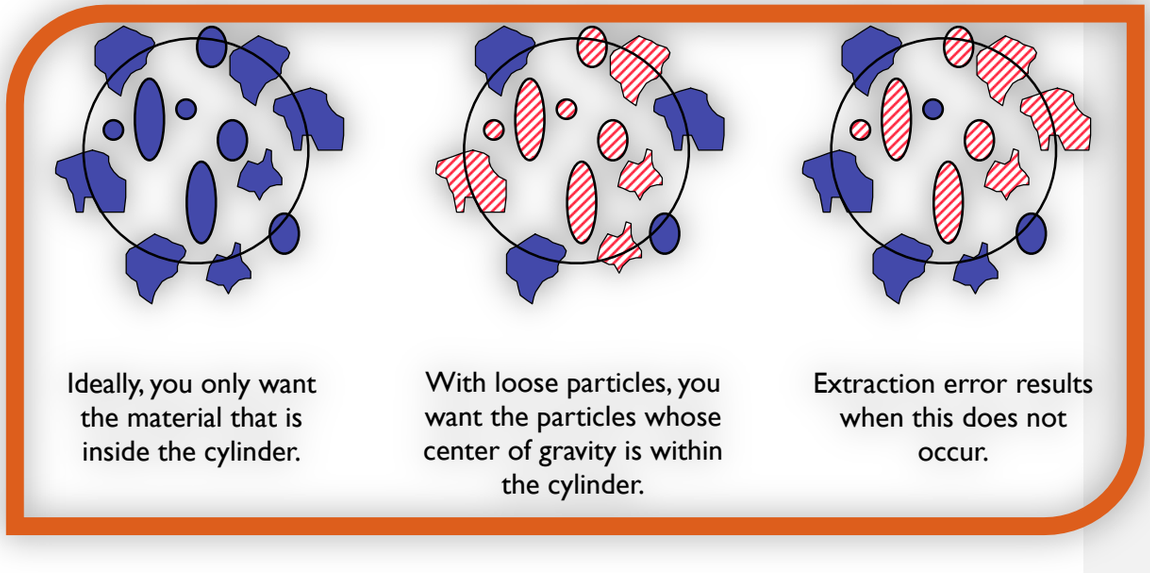

Figure. Example of correct delimitation.

Mitigation of biases associated with sample correctness is achieved with properly designed tools and proper use of tools. In some cases general rules can be provided: in other cases, only with careful inspection of the sampling device can sample correctness be observed.

There are other characteristics that sampling tools need to possess.

- They need to be simple and reliable. Even the best cared for tools end up taking a lot of abuse in the field. If the tool fails the sampler will be tempted to improvise which may lead to collection of an insufficient sample that will not meet the SQC.

- If the tool is to be reused, it must be easy to decontaminate. Tools with small openings, inaccessible openings, etc. will be very difficult to decontaminate. If it takes time to disassemble the tool there will be a temptation for the sampler to skimp on the cleaning which may lead to cross contamination.

Sampling Dimensions

Ideal Increment Shape

- zero dimensional (take one)
  - random units
- one dimensional (take random slices)
  - two dimensions are small compared to third
- two dimensional (take random cores)
  - one dimension is small compared to other two
- three dimensional (very difficult)
  - reduce the dimension of the material

Need to capture the "dimensions" of heterogeneity

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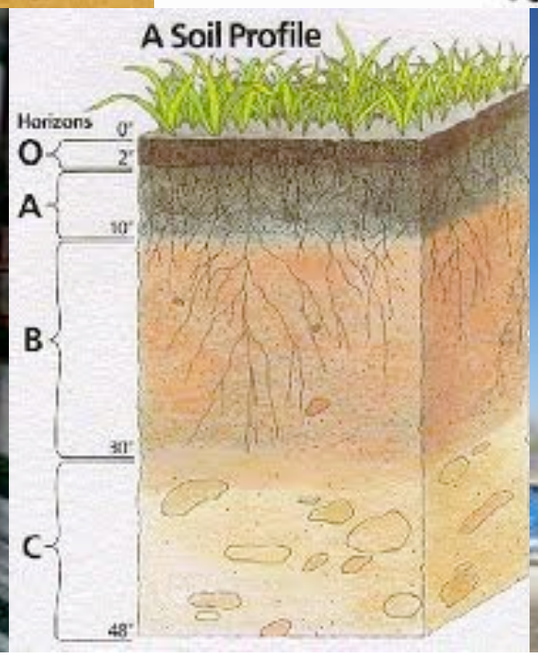
Tools

- Typical types
  - probes (triers, double walled, Missouri D)
  - scoops (plastic, metal, hand)
  - automatic
- Ease of sample collection
  - zero (cans of tuna at the store) - unit
  - one (conveyor belt at loading facility) - slice
  - two (surface soil in a field) - cylinder
  - three (large pile of grain) - sphere
- If the dimension can be reduced, the sampling is easier and more representative (if performed properly)

Quiz



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Tool Limitations

- Probes
  - do not go to the bottom
  - difficult to clean
  - need flowable material for some
- Scoops
  - only sample a small area
  - cannot get to the bottom
- Hand
- Automatic
  - maintenance
  - design

The Past, The Future

- Tools and techniques for protein, fat, fiber, moisture... may no longer be adequate
- New world
  - new analytes
  - trace analytes
- What was adequate in the past is not adequate anymore

Selection Characteristics

- What dimension/size of decision unit
- Matrix type (solid, liquid, gas, sticky, fines)
- Size of particles
- Analyte characteristics (organisms, trace levels)
- Tool characteristics
  - durable
  - easy to clean and maintain
  - safe to use

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In order for a tool to be a "proper" tool it must meet several characteristics such as it must be easy to use, must be maintained and easily cleaned after each sample and kept clean, must have the integrity to withstand sampling a material without breaking or adulterating the analytes, be able to collect all the particles, largest and smallest in the decision unit, the analyte does not sorb to the sampling tool, and it does not react or degrade the sample or media.

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Summary

- Tool selection is very important
- Proper tool use is very important
- Inspectors must have proper tools in good working order
- Tools need to be cleaned for trace level analysis