AusIMM Coal Sampling Seminar

SA HB196
Sampling in Coal Preparation Plants

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Why are we doing this?

There are many existing standards covering the sampling of coal (eg ISO13909, ISO18283 and ISO20904) so why is this needed?
What would we like to achieve

- Sampling has not been an important factor in Coal Preparation Plant design, even though it can deliver significant benefit.

- Provide a handbook that will give practical advice to the operator where representative sampling is difficult to achieve.

- Practical means of sampling unit operations within existing plants generally relies on a compromise between sample representativity (minimisation of bias) and sampling feasibility.

- The handbook does not endorse poor sampling practice, but instead offers practical guidance to overcome, to the extent reasonably possible, real-life limitations.
Guidance and recommended practices for Sampling in Coal Preparation Plants (CPP) not covered adequately in existing Standards.

Excludes particles with top size greater than 63 mm.

Focuses on unit operations within the process, and not conveyor belts or transfer stations that are adequately covered by the existing Standards.

Includes typical quantitative and qualitative information with notes, decision trees, safety issues etc.
## Typical minimum volumes

<table>
<thead>
<tr>
<th>Stream</th>
<th>Typical Volume</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spirals(^a)/HBS</td>
<td>1 x 20 L bucket</td>
<td>Assumes &gt;15% solids all streams</td>
</tr>
<tr>
<td>Classifying /Thickening cyclone feed</td>
<td>2 x 20 L bucket</td>
<td>Assumes &lt;10% solids</td>
</tr>
<tr>
<td>Classifying/Thickening cyclone underflow</td>
<td>1 x 20 L bucket</td>
<td>Assumes &gt;20% solids</td>
</tr>
</tbody>
</table>
Some Sampling Problem Areas

- Sampling from **drain and rinse screen discharges**
- Sampling **Slurries** from pipes
- Screen underpans
Sampling from Drain and Rinse Screens
## Recommended Sampling Devices

<table>
<thead>
<tr>
<th>Stream</th>
<th>Sampling Device</th>
</tr>
</thead>
<tbody>
<tr>
<td>Desliming and Drain and Rinse (D&amp;R) Screen overflows</td>
<td>Slide or Swing bucket (lever operated) with means to discharge sample or mechanical lift to raise bucket out of discharge chute.</td>
</tr>
</tbody>
</table>
Typical Screen Discharge Sample
When carrying out manual sampling of a slurry, the following aspects should be considered:

- Consider safety of operators, good access to sampling location;
- Slurry flow to be presented in a manner that the increment mass can be safely handled by the operator;
- Provide good access to the full slurry stream;
- Opening of sampling implement to be greater than 3 times the coal top size and 20 mm minimum;
- Width of sampling implement should all be longer than the width of the slurry stream to ensure full width is sampled in each pass;
- Design criteria as per mechanical cutters apply, e.g. constant speed, maximum 3.6 m/s speed, sufficient cutter volume and splash resistant.
Problems in Sampling Slurries

- Getting access to take manual representative slurry samples safely is particularly difficult.

- Slurries can vary significantly in a coal washing plant:
  1. Homogenious where solids are distributed symmetrically across the pipe and travel at the same velocity as fluid;
  2. Heterogeneous where solids are distributed asymmetrically across the pipe and travel slightly slower than the fluid;
  3. Sliding bed where a portion of the solids slide along the bottom of the pipe and travel at lower speeds than fluid.
What is currently in use?

- There are many gauges in the market that claim that they are able to take representative samples and provide immediate slurry results from pipe work. They are, in many situations, biased when they work but are also very prone to blockages so do not always work.

- They are cheap, easy to install and for a time appear to work well but the results in many cases can often be misleading.

- Our handbook clearly outlines that samples taken in this manner should not be used in coal preparation plants.
Slot Sampler

(Courtesy of Heath & Sherwood)
Sample Spear

(from ACARP Project C16005)
Retrofitted by-pass system

a) By-pass position

b) Sampling position

(Source: ISO 20904)
Vezin Sampler

(Courtesy of BHP Mitsubishi Alliance)
Sample Correctness

A: Constant speed of rotation (Vezin-type) full-stream cut (fully representative)

B: 'Point' sampler (single fixed aperture such as an inserted tube) (always non-representative)

C: Tee off side of pipe (always non-representative)

D: Full-diameter spear (always non-representative), but a significant improvement on B or C. Hole profile tailored to progressive cross-section change across pipe.
Underpan Sampler
References

- ACARP Project C19041
- AS 1038.21.1.1 Higher Rank Coal and Coke Relative Density
- AS 2418 Coal and Coke Glossary of Terms
- AS 4156.1 Coal preparation – Higher Rank Coal Float and Sink Testing (2018 revision, in publication)
- AS 4156.3 Coal preparation – Magnetite for coal preparation plant use – Test methods Magnetite
- AS 5213 Density Tracers (in publication)
- ISO 8833 Magnetite for use in coal preparation — Test methods
- ISO 13909 Hard Coal and Coke — Mechanical Sampling (series of sampling standards)
- ISO 13909.2 Hard Coal and Coke — Mechanical Sampling Part 2: Coal – Sampling from moving streams
- ISO 13909.7 Hard Coal and Coke — Mechanical Sampling – Part 7: Methods for determining the precision of sampling, sample preparation and testing.
- ISO 18283 Hard Coal and Coke — Manual Sampling
- ISO 20904 Hard Coal — Sampling of Slurries


Conclusions

A small snap shot of the work completed.

The Handbook clearly emphasises **Safety and Planning** as prime considerations in manual sampling within plants.

The handbook indicates clearly that manual sampling can be improved at many locations. For example making falling streams more accessible such as designing screen chutes slightly wider.

Our plea to Coal Plant designer (sellers) is to provide provision in their designs for sampling in the major product and reject streams within the plant and that Coal producers (buyers) will agree to have them in place (ie pay for them).
Many thanks to the following

- The members of the Working Group:

- Dr Dave Osborne Chairman of MN2.
- Ahshanur Rashid Standards Australia.
- ACPS for permission to use some photos and data.
- You for listening to me today!