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# Sampling- The Black Hole in Fibre Measurement & Quality Management Processes

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# Opening

- Pulp mills, paper mills, pellet plants, bioenergy plants and board plants record and pay for thousands of fibre transaction worth millions of \$'s based upon net weights and 'representative' oven dry sampling
- Residual suppliers, whole log contractors and bush grinding contractors rely on the buyers expertise for precision and accuracy in measurement
- Truckers typically paid identically

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# The Purpose of this Presentation

- The sampling of fibre for oven dry determination is the 'point of risk' for sellers and buyers of fibre
- Fibre sampling error outweighs all other forms of error:
  - Weight
  - Sample Integrity
  - Sample splitting
  - Lab processes

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# How Did I Get On to This?

- Early in my consulting career I concentrated exclusively on fibre quality and technical issues
  - I audited over 10 mills in northern & central BC, Alberta and the USPNW for measurement practices
  - In each and every audit....I found issues with sampling
  - Then I got involved in a measurement lawsuit between a supplier and pulp mill
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# Why is Sampling So Crucial?

- Trucks; typically 4 green kilos are sampled from a 40,000 kilo load
  - Sample represents 1/10,000 of the population
- Barges; typically 4 samples at 4 green kilos are taken from a 2,000,000 kilo load
  - Sample represents 1/125,000 of the population
- Fibre is not homogenous, therefore the representativeness and integrity of the sample are crucial to the precision of the BD%, payment and credit to inventory

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# The Process

- **There is no Standard for Fibre Transactions**
- There are Tappi Useful Methods and accepted principles but nowhere is there a cookie cutter system for fibre transaction
- Therefore, we know in law, the Reasonable Man Standard rules

# The Practical Process

- For weight fibre purchasing systems
  - Trucks weighs in
  - Truck dumps
  - ***Sample taken***
  - Truck weighs out
  - Net weight determined
  - Sample handled in lab, weighed, dried, reweighed and oven dry % determined
  - Net weight x OD%/unit of measure x \$'s = payment

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# The Process in Parts- Fibre Weight

- Truck weights
  - Rarely an issue
  - If scale not precise- wrong on both ends
  - Truckers know what they carry (different mills) and speak up
  - Scales typically calibrated for 'trade' and usually calibrated for ISO systems

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# The Process in Parts- Sampling

- A sample is taken; 8 to 10 liters is a typical size
- Sample typically taken be taken by truck driver; in some cases mill employee
- Where and how is it taken?
- Therein lies the problem!!

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# The Process in Parts- Chip Lab

- Most Labs ISO 9001 Certified
  - Receive sample
  - Prepare/split for OD% & Quality Classification
  - Into ovens; onto classifiers
  
- If issues
  - Balance calibration
  - Manual splitting
  - Oven temperature, oven retention time

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# Case Study #1- What Goes Wrong within Sampling

- At a pulp mill in northern BC a sawmiller visited the pulp mill he supplied with chips for a tour of the receiving and lab area
  - ❑ Saw something he didn't like, in sampling
  - ❑ Complained verbally
  - ❑ Complained formally
  - ❑ Sued
  - ❑ Went to Court
  - ❑ Supplier won; big \$'s

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# Case Study #2- What Goes Wrong in Sampling

- In 2003 I was asked to provide a formal audit of the receiving and measurement for a pulp mill in the USPNW
  - Audit finding: *The sample of wood chips used to derive the BD% is typically taken as the driver opens the back of the truck tailgate, just prior to dumping the load. It is believed, however, that the resultant bone dry weight of the chips resulting from a sample from the back of the truck may be greater than the average for the entire load since the chips at the back of the truck are subject to some degree of drying as they are moved from the source mill to the KC mill. If this were true, then the calculation of the dry weight of the load of chips would be too high and xx would, as a result, be paying too much for chips they receive.*

# Case Study #2- Turn a Theory into

- *The methodology used for the trial was to observe the driver take his tailgate sample, confirm the load ticket number and then take the trial sample at the suspension point at the bottom of the back side of the truck dump reclaim system. The trial sampling point is the same point proposed for mechanical samplers to replace the current tailgate/driver system. The trial samples were taken using a specialized telescopic sampling device that could be safely entered into the chip flow at a representative point. Two trial samples were taken for each truck and co-mingled; the first at the 1/3 dump point and a second at the 2/3 dump point*
- *Take 30 paired samples this way*
- *Use Minitab to run 'paired samples' statistical analysis*

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# Design a Sampler for the Test



# Driver Samples Normally



# Sample Representatively Taken at the Same Time



# The Results

	<b>Average BD%</b>	<b>Standard Deviation</b>
Tailgate Samples	49.9	3.7
Representative Samples	48.8	2.3
Difference	1.1	2.8
Range of Differences	4.7 to -1.8	n.a.

# Case Study #2- The Results

- **Average difference between samples= -1.1%**
- **Plausible range of difference = -2.13% to -0.04%**
- The average difference between the BD% sampled at the tailgate and one taken from a representative point within the load is about -1.1% , and
- Reasonable certainty (with a 95% level of confidence, or on average 19 times out of 20) that if all loads are sampled, that the difference between the BD% taken from the tailgate vs. the representative point within the load will be between **-2.13% to -0.04%**

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# Case Study #2- The Cost Implications

- If we substitute the lower BD% indicated by the results of the trial, the payment to suppliers for chips delivered is dramatically
- The effect of the artificially high BD% from tailgate sampling when applied to annual receipts was \$450,000 or a 2.14% overpayment.

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# Case Study #2- Resolution

- The mill installed an automatic driver activated sampler
- A small conveyor (4") with drag chain/flite which reaches into the chip flow at the point of suspension between the pit conveyor and the belt conveyor
- Sampling is continuous and the driver 'randomly' chooses when to take it

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# Conclusion- The Problem Restated

- With all forms of residual wood fibre the sampling process is the crucial measurement step in the payment and inventory process
- 90+% of the errors in fibre payment transactions can be attributed to sampling error

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# Conclusion- Solution

- To representatively sample fibre
  - Always use 'reasonable man' theory as your guide
  - Find the best location in the delivery process
  - Sample mechanically, if you can
  - If you sample manually, make it consistent and police the process

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# Questions

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Thank you

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