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# Measuring the moisture content of wood chips with Troxler's DMG 4302 nuclear probe

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## Abstract

FERIC's trials demonstrated that the Troxler DMG 4302 nuclear probe permits rapid and accurate measurement of the moisture content of wood chips. In addition, it can be used year-round, either independently or integrated within an automated sampling system.

## Introduction

Several tools permit more or less rapid and accurate measurement of the moisture content of wood chips. Of the available options, neutron-count technology can be used in any season, even with frozen chips. Our study sought to measure the accuracy, ease of use, and reliability of a measurement tool based on this technology.

## Description of the probe

The Troxler Electronic Laboratories Inc. DMG 4302 probe (Figure 1), a 30×4.7 cm cylinder, contains the neutron source and receivers. Its expected working life is 15 years. Use of the device requires a permit from the Canadian Nuclear Safety Commission (CNSC).

Figure 1. The Troxler DMG 4302 nuclear probe.

When linked to a battery-powered control unit with a 3-m cable (or an optional 60-m cable), the probe can operate autonomously, without supervision, or can be linked to a computer for data collection and processing. Its operating radius varies in inverse proportion to the moisture content, and thus, the readings represent the average moisture content of a 15- to 90-L volume of chips. The probe can be used at the mill scale, inserted into a trailer via the side door, or mounted in an aluminum tube within the feed hopper.

## Results of our trials

We compared each probe reading in the trailers with the moisture content of a 6-L sample removed from around the probe's position and oven-dried; in the hopper, we compared each reading with the average moisture content of six 3-L samples. These trials, performed at six different mills, used both softwood and hardwood chips in winter and spring.

A linear relationship, which depended on the wood's density and thus its species, was established between the probe's readings and the moisture content of the chips. Differences between the moisture contents determined by drying and the probe's estimates were less than 1% in 70% of the cases, less than 2% in 90% of the cases, and less than 3% in 97% of the cases. The results were comparable for softwoods and hardwoods, with the best results obtained in the hopper, where all differences were ≤2%.

In the hopper, the difference between the probe's estimate and the sample average was always less than that between the smallest and largest values for the same samples; in more than 70% of the cases, the probe provided a more accurate measure than that obtained using the range of sample values.

## Implementation

- Use of the probe requires knowledge of the wood species and its density so the correct coefficient can be applied.
- Incomplete insertion of the probe prevents the establishment of a relationship between its readings and the moisture content; thus, the probe must be covered by chips along its entire length. To prepare for its insertion, use a tool such as a drill bit (Figure 1) or a hollow tube. This approach avoids creating cavities or allowing the chips to collapse, which would impede penetration by the probe.
- The probe's readings are a statistical measurement, and thus require a minimum sampling duration. The *optimal* duration must be established based on the operating conditions at each mill. In an automated system, the probe could be inserted with an auger to provide a reading in 2 to 5 minutes.
- With a permanent access tube in the hopper, measurements can be taken continuously to obtain a representative moisture content for an entire load. This system would thus reduce the need for oven-drying to a small number of measurements for quality-control purposes.
- If such an installation could reduce the number of samples required for measuring moisture contents by 80%, an operator would save around 2.5 h/day (for 100 trucks/day). The costs of the probe are as follows: purchase, $7400; installation and integration with a computer system, $1000 to $3000; CNSC permit, $650/year; leakage tests, $100/year. If the operator earns $20/hour, the purchase and installation costs would be recovered in less than 8 months, and the company would only have to cover the annual cost for a permit, leakage tests, and maintenance.

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