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A TRAIL THROUGH THE LODGEPOLE PINES

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1. Introduction

I thank the Association for inviting me to your annual meeting. It's one I've enjoyed addressing before and it's a great honour to be asked to start the proceedings today. I'd like to use the opportunity to talk about some aspects of the Canadian treating industry. My observations will likely seem simplistic but perhaps sharing my view from afar will help you focus on some actions I think could enhance your industry's future.

Canada has many attributes of which it can be proud.

- Despite your country's very large size and low population, Canada acts as a stabilizing influence on world affairs
- You can boast several of the world's finest cities, this one included
- The Canadian stretch of the Rocky Mountains is the grandest of the entire chain
- You have made bilingualism work
- For 5 years running your government's use of the 'World Wide Web' to promote public services has been voted 'best in the world'
- You have a government agency – Environment Canada – that has shown an ability to work with a (sometimes reluctant) treating industry for the benefit of the nation
- You have several world-class wood research centres. From coast to coast your Universities and industry laboratories are renowned for their work on wood chemistry, physics and engineering
- This association, the CWPA, has for many years set a high standard in sharing technical information at its annual meetings. I'm sure this one will be no different.

It's a list of which you can be proud, yet I have always felt sorry for Canadians over one matter. The species of wood that grow here, by and large, are not easy to treat. It is this handicap that I'd like to concentrate on today and I'll suggest ways you might make things better for yourselves.

2. Concern for the environment

The major purpose of a wood preserving industry is, of course, to minimize the various costs of replacing failures due to decay or fire. This in turn reduces the stress on forests, which in Canada are a very important natural resource.

The major downside of CCA turned out to be disposal of wood at the end of its useful life. Having said that, CCA also had to be carefully handled to prevent contamination of workers or the environment. Believe me, no treater sets out to harm his staff or turn his real estate into negative equity. But, even with the best-designed plants, accidents will happen.

Now CCA has been replaced for many end-uses by chemicals seen as less risky. Looked at from outside the industry, that's a positive change, though some of you may be less than delighted! Anyway, the new offerings should reduce the risks I've referred to.

3. Your customers

Commercial and residential users of your products are very fortunate, whether they realize it or not. For a modest extra price over untreated wood they can buy products with service lives several times as long. These are often more cost effective than alternative metal, plastic or cement-based offerings. When Life Cycle Analysis estimates whole-of-life costs, both financial and environmental, treated wood is usually clearly least expensive.

Not surprisingly, customers wish your products were even more reliable, more consistent in appearance and even less expensive. This is the challenge your have to recognise and tackle if you want your companies to grow.

4. The industry and its future

The Canadian wood preservation industry has a proud history of adding value to the products of your forests and sawmills. You have worked alongside Environment Canada to improve the safety of your plants, employees and their surroundings. Your new preservatives may offer a better balance between performance and safety but the change has come at a price. The higher cost of the new preservatives has made your industry less competitive and only time will tell how long your products will resist decay.

I called this talk *'A Trail Through the Lodgepole Pines'*. This odd title may conjure several images. What did I mean?

- a pleasant walk through one of your forests?
- liquid under pressure making its way through the cellular structure of wood?
- the Laurel and Hardy *'Lonesome Pine'* signature tune that enhanced their movies, some of the funniest ever made?

Maybe all three – but there was certainly a pretty serious reason for including one of the wood species your forests yields, your industry treats and your scientists study. Successful as your treaters may be, they are challenged every day by their raw material. You are not blessed with many species that treat quickly or uniformly. As a result, some

items are over-treated, some under. Compared to the USA, where southern yellow, ponderosa and red pines treat fairly easily, maintaining consistent quality in Canada is a nightmare. Treating times are long and plant throughput low, boosting the fixed-cost element of your process.

After treatment, more time can be wasted waiting for the product to stop dripping and dripping outside the treating cylinder has to be managed safely, adding yet more cost.

To grow your industry you need to improve the efficiency, quality and uniformity of your treating process. How can this be done? I'd like to suggest some avenues for you to consider, both as individual treating companies and as an industry. They concern your *preservatives*, your *treating techniques* and the *wood* you bring in for treatment.

Preservatives

Your chemical suppliers spend a lot of time and money developing, testing and seeking approvals for the next generation of wood preservatives. ***You would waste time and money if you attempted to find better chemicals yourselves. Leave this to your suppliers.***

Treating techniques

Conversely, preservative suppliers have no interest in helping you to use less chemical to do a given job - this is your responsibility. If you don't accept the challenge, the improvements demanded by your customers will not happen and you will lose market share. Whether action should be undertaken by individual companies or collectively is up to you. My view is that the cooperative approach is more likely to succeed. It offers each contributor more benefits at less cost. Maybe it can be organised through CWPA, although not all members will join in. Canada's world-class R & D centres referred to earlier are quite capable of undertaking research for and development of treating improvements.

Let me suggest one area worthy of study in water-borne treating. It could solve one source of inefficiency in Canadian treating plants. Think of a typical charge of coastal hemlock leaving the cylinder. When freshly treated, products often will drip for a long time, maybe 24 hours. The combined drips have to be returned safely to the treating system so health and the environment are not compromised. Valuable time and space is wasted waiting until the wood can be removed for further conditioning before storage or shipment. I understand this is especially a problem with coastal hemlock, hembal and amabilis fir.

Why does the wood drip and could we stop it? As far as I know, this has never been studied properly. I believe the problem is due to a largely ignored property of water. Picture preservative oozing out of wood, sometimes for 24 hours or more. Is the wood shrinking and squeezing the water out? Is the water expanding? I believe the answer to both questions is 'NO'. Both water and wood are fairly incompressible. So what is the motive force behind dripping? The explanation lies in the fact that our carrying liquid is not simply H_2O. It is much more complicated than that. In normal atmospheric conditions, water also contains about 3-5% by volume of gases dissolved from the air, mostly nitrogen and oxygen *[Lide, David R., 1991-2, Dean, John A.]*. These gas molecules fit pretty efficiently between water molecules and scarcely change its volume. This gas content of water is variable. Sufficient oxygen in lake water, rivers and

oceans is critical to the survival of fish. More gases will dissolve at higher pressures. For instance, we know that deep-sea divers absorb very high levels of nitrogen in their blood. Before returning from a dive, their bodies must be returned slowly to surface pressure while the excess gas is expelled through the lungs. Otherwise, gas bubbles forming in their blood will kill them. Not all fizzy water is labelled *'Canada Dry'*.

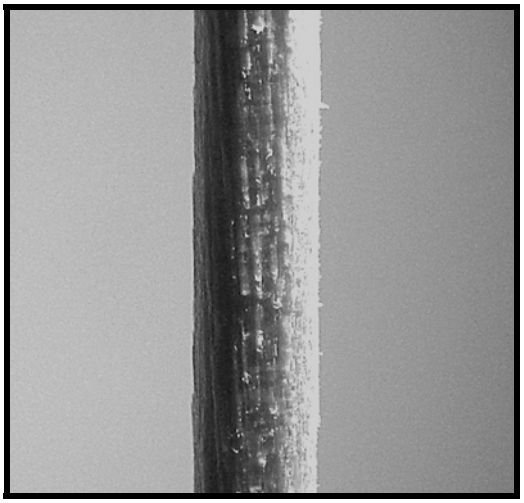
Now, think about the pressure fluctuations during treatment and the ready availability of air in the equipment and the wood cells. It's easy to speculate that the gas content of preservative can increase while in the cylinder under applied pressures ten or twelve times those of the work tank. When the charge is taken from the cylinder and returned to atmospheric conditions, gases dissolved at high pressure will be supersaturated. They can no longer be held in aqueous solution and will return to gaseous phase, building pressure inside the wood. I believe this growing pressure then forces preservative out at the wood surfaces. The 'venting' of gases can take time. A glass of soda water will bubble for hours as the dissolved CO_2 regains equilibrium with the level in the surrounding air. At the treating plant, dripping will only stop when the gases dissolved in the preservative approach equilibrium with ambient conditions (Figure 1).

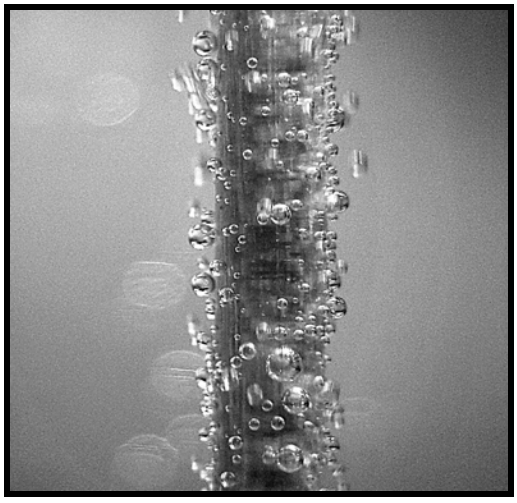
***Figure 1**: **Natural degassing of water**. The two photographs show the result when a small wooden cocktail stick is immersed in water. If the water holds more gas in solution than current conditions allow, excess gas changes from a dissolved state to gaseous phase in the form of bubbles, increasing the vapour pressure in the system. The rate of gas discharge increases when a rough surface (e.g. the stick) is introduced. This appears to provide nucleation sites for bubble formation.*

It is suggested in the paper that such an effect will occur inside freshly treated wood when the pressure period ends.

a) water with little or no dissolved gas – no gas phase forms

b) water supersaturated with gas under pressure then brought to a lower pressure – bubbles form immediately, especially on rough surfaces





Well, you've heard my hypothesis – can you think what else could force water out of softwoods for many hours in static conditions? Proving or disproving it is a job for well-equipped wood scientists and you have plenty of these in Canada. For the above reason alone, I suggest you sponsor studies of water/gas relationships during treating.

There are other reasons too. We all know you can't get oily stains off clothing using just cold tap water. You need soap or detergent, and it will work better if the water is hot. Recently, it has been confirmed that cold water, freed from all dissolved gases, is capable of removing oily stains on its own *[Pashley et al., 2005]*. The gas content of normal water seems to prevent wetting of the oil and degassed water does not share this handicap. Publication of this finding created a lot of media attention, e.g.

> **Sunday Times, London, Feb. 6, 2005***: "The soap industry, worth an estimated £2.3 billion* [~$CAN4.6 billion] *a year in Britain alone, is unlikely to be enthusiastic about Pashley's findings, although environmentalists will cheer any reduction in the use of detergents, which promote environmentally damaging algae growth when washed out into rivers and streams.*
>
> *A spokesman for the UK Cleaning Products Industry Association "What customers value is performance and we don't think that using water could clean clothes to an acceptable standard."*

It's no surprise that the surfactant industry is unenthusiastic. But treaters should see this as an exciting opportunity. Maybe modification of your cheap, easily available carrier liquid will improve penetration, shorten charge times, and eliminate dripping delay. In short, if the gas content of the water can be managed to your advantage, might this revolutionise your treating economics? ***I think the potential benefits easily justify an investment in water/gas research.***

Wood sourcing

Many of the products you treat are graded using Canadian Lumber Standards (CLS). Thus, it may seem that they will perform within specified limits. The truth is that little of the scrutiny applied to the bright items you receive for treatment says anything about their behaviour in a treating cylinder. No consideration was given to the likely uptake and penetration of liquid preservatives. The early days of wood preservation mostly concerned rail ties or poles. The railroads, power and telephone companies set their own standards for wood purchase and treatment. The CLS and the American Lumber Standards Committee (ALSC) standards were developed later to ensure the strength of buildings and other construction projects. At that time, not much lumber was treated, certainly not with water-based preservatives, so no attention was paid to what was best for the treating industry. This void in specifying wood for treating needs filling - but how?

One of the fundamental problems is the mixture of tree types allowed by the rules: hem-fir, the spruce-pine-firs, fir-larch, etc. These combinations have been justified on the basis of strength - there is no promise of similar treating behaviour. Often you experience the very opposite – you *know* they will treat differently. One of the fundamentals of efficient treatment is that you fill your cylinder with pieces of wood that will behave similarly in the pressure process. That means careful selection of shapes, species and pre-treatment conditioning. Public safety is the reason the standards were introduced, and bad treatment caused by variation within a batch will lead to early failures of equal severity to those arising from dead knots or sloping grain.

I already said that the USA has a somewhat easier time than Canada as some easier-to-treat tree species grow there. Yet, about ten years ago, some of us in the US industry were demanding a seat with the 20+ members of the ALS Committee. Every year, millions of ALSC-specified 100 x 100mm (4" x 4") posts went to treating plants. It's hard to think of a use for a 4 x 4 that's not outdoors, or in ground contact. So it needs treatment. Pine decking is a similar example, though for above ground use. Yet the Committee, under the stewardship of the US Department of Commerce, had no representation from the treating industry. It was assumed our needs were 'spoken for' by the mills or by quality inspecting firms. Despite our industry's huge purchases from saw millers, we had no voice of our own. In fact, many of the bright wood interests were actively *against* our inclusion and we had a to fight hard for a seat. Finally, Commerce created an extra seat for us and at last we could propose changes to benefit treaters - better moisture testing was an early example. Much more remains to be done, especially in species selection.

In Canada too, you need more say over your bright wood supply. Ideally, your cylinder should be filled with wood of one species from the same forest and the same mill. Uniformity of behaviour is the key to efficient treating. If you accept deliveries of mixed species or uneven moisture contents you condemn yourselves to waste of time and chemical and you still will not achieve uniform treating quality. The mills will say it is impossible to sort trees by species, to keep them apart during milling, that your drying requirements are too onerous, and so on. As large customers you can and must make demands of these mills to make your business more profitable. As I read the rules, a consignment of a mixed grade such as 'hem fir' would be meet grade if only one of the individual species allowed was present. ***Make the mills select for you, the customer. Seek and use representation on your standards-writing bodies to design your own 'Grading Rules' with treating behaviour the number one criterion.***

5. Summing up

1) Press your chemical suppliers for safer, more convenient, less expensive preservatives but don't expect them to overcome your treating difficulties. It's not within their capability or in their interest to do so.
2) Canada has the R & D facilities and expertise in place at universities and facilities like Forintek to improve the cost effectiveness and perceived quality of treated wood. I've suggested one topic of research involving your second biggest raw material – water. There will be other avenues you might explore in

the quest for more uniform, less costly treatment. This will please your customers, fight-off competitor materials, lead to business growth and help ensure the industry's future.

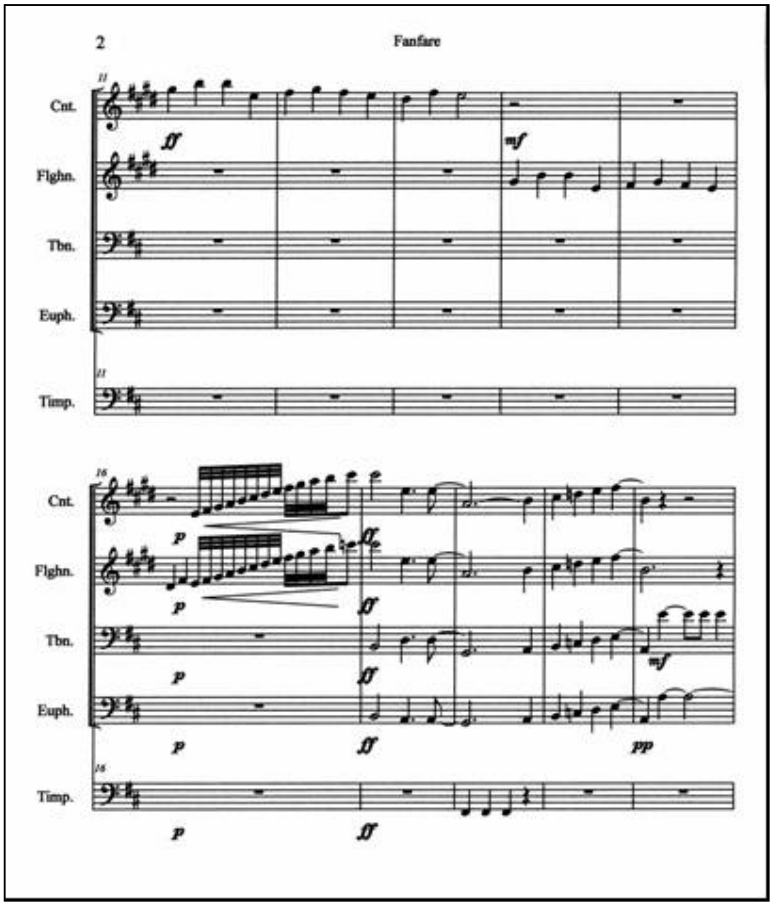
3) Canada's independence and resources are of great value to the world in several ways. Your foresters and saw millers yield huge volumes of wood yet give little thought to how suitable it is for one of their largest customer groups – the treating industry. Work with the mills and standard setters to change this for the better. Demand wood that treats more uniformly. Ultimately, all involved will benefit from the improved business this will bring.

6. Fanfare

I wish you all a good conference. To start it off with flourish, I'll play you a fanfare called '*A Trail through the Lodgepole Pines*'. I wrote it to honour your *'Home and Native Land'* and the many facets of *'The True North Strong and Free'* from the Pacific coast to the Maritimes. Listen carefully and you may also get a chuckle out of Laurel and Hardy!

I'd like to dedicate this first performance to the memory of Dr. John Levy who died earlier this year. Many of you knew John - some personally, others as a keynote speaker at your meetings. As professor of wood science at Imperial College, London University, John created a research team that led the world in advancing our knowledge of wood decay and protection. He worked with the UK's Forest Products Research Laboratory to reveal how both bacteria and soft rots were often implicated in the decay of inadequately treated wood. His work, his crystal-clear presentations and his big personality will be long remembered. ***[Playing of fanfare: Figure 2]***

Figure 2: Fanfare: a Trail through the Lodgepole Pines, *written especially for the meeting (extract: measures 11-20 of 74, for those with a musical inclination). This section starts with a unique 11-note motif on Bb cornet then Bb flugelhorn, bridging into the start of the Canadian national anthem, adding the trombone, euphonium and timpani.*
Later, other themes are interwoven: Laurel and Hardy's famed 'Trail of the Lonesome Pine' and a Prince Edward Island step-dancing version of a traditional Quebec tune, 'Queen Anne's Reel'.



The music was notated on 'Finale' software (www.finalemusic.com)

7. Literature

1. *Lide, David R.* editor, **The Handbook of Chemistry and Physics**, 72nd edition, Chemical Rubber Press, Inc., ***1991-2***.
2. *Dean, John A.*, editor, **Lange's Handbook of Chemistry**, 13th edition, McGraw-Hill, Inc., ***1985***.
3. *Pashley, R. M.; Rzechowicz, M.; Pashley, L. R.; Francis, M. J.;* **J. Physical Chemistry B.** ***2005;*** **109(3)**; 1231-1238.