



# ENVIRONMENT

# Technological Innovation



## ABSTRACT

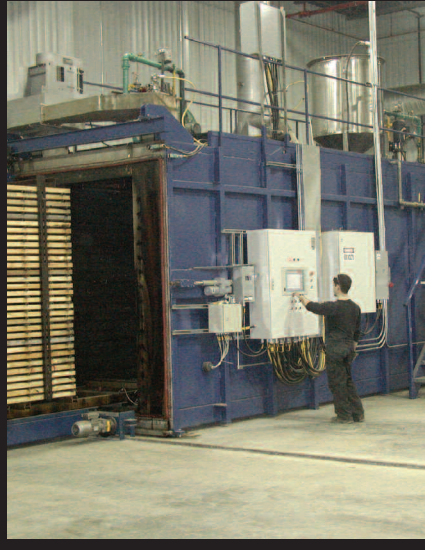
The environmental and public health concerns that arise from the chemical treatment of wood have brought about the development of greener alternatives.

PCI Industries Inc. has created a heat treatment technology for wood (the Perdure™ technology) that does not require any added chemical agents and which sterilizes and protects the wood against microorganisms and insects (except termites), and improves its dimensional stability.

This technology, an ecological substitute for chemically treated wood, extends the service life of the wood and can be used on all species. Also, the heating process alters the colour of the bulk wood, leading to the production of exotic wood substitutes.

## INNOVATIVE TOOLS AND PROCESSES

**PERDURE™ :**  
**HIGH TEMPERATURE**  
**WOOD TREATMENT**



## HIGHLIGHTS

### Technology

- High temperature wood treatment (230°C);
- Effective on all species;
- Increased dimensional stability of the wood.

### Environment

- Chemical-free process;
- No toxic emissions;
- 100% recyclable and non-toxic;
- No risk of soil contamination.

### Cost

- Lower-priced species can be treated;
- Exotic wood substitutes can be produced at a fraction of the cost of the natural woods;
- Less deformations caused by sun or weather damage;
- The service life of the wood is equivalent to that of chemically-treated wood;
- Energy consumption is decreased through the reuse of combustion gases.

# PROJECT OBJECTIVES / PHASES

The PCI project aimed at developing and marketing a technology that could substitute the chemical and toxic impregnation substances generally used in wood treatment.

**History:**  
1999 – Study of the physico-chemical properties of Perdure™ wood conducted at Canada’s Wood Product Research Institute (Forintek)

2000 – PCI purchases the intellectual property rights to the Perdure technology

2002 – The *ministère du Développement durable, de l’Environnement et des Parcs* grants an authorization certificate for the construction and operation of a high temperature wood treatment plant in St-Ambroise (Québec)

2003 – The new Écobois plant opens in St-Ambroise (Québec)

2003 – A new plant using the Perdure technology opens in Cacouna (Québec)

2004 – A partnership between PCI and *Université du Québec à Chicoutimi (UQAC)* is established to implement a Perdure technology research facility

2005 – The Kisik Technologies plant opens in Dolbeau (Québec)

2005 – A report on the characterization of the atmospheric emissions released by a heating oven in Dolbeau (Québec) is completed

## BACKGROUND

The lumber used in construction can begin to degrade when exposed to harsh weather conditions. Treatments using chemicals such as chromium copper arsenate (CCA), pentachlorophenol (PCP) and creosote can delay this degradation and preserve the wood, increasing the service life of outdoor wood by 5 to 10 times.

Chemically treated wood can, however, negatively affect both human health and the environment, prompting the industry to find new, greener treatments. In fact, in 2003, an agreement was reached with Canadian manufacturers who voluntarily withdrew CCA from the residential market.

## TECHNOLOGY

The Perdure technology involves:

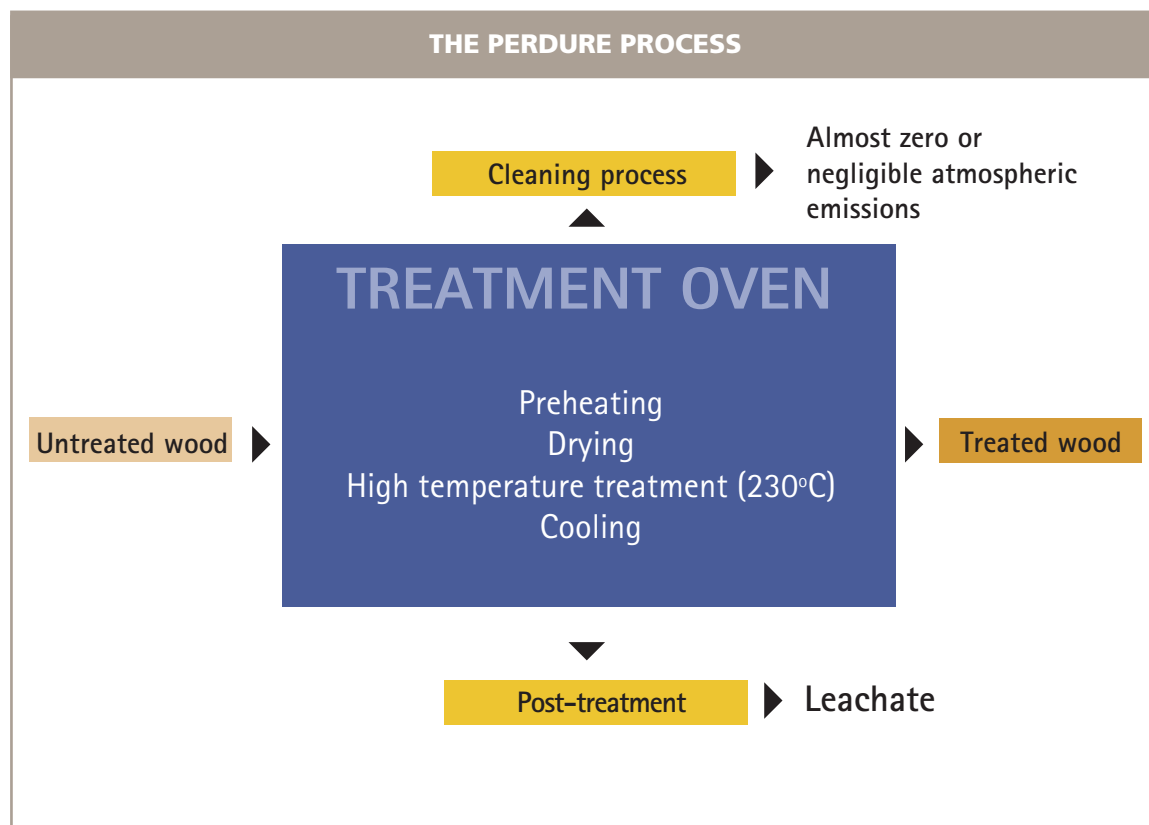
- A treatment chamber;
- Two combustion chambers;
- Mixing turbines for gas flow and to stabilize the temperature in the treatment chamber;
- A water tank (an integral part of the modular oven) to cool the wood and a post-combustion system;
- Oven autodiagnostic, discrepancy treatment, and follow-up systems;

The technology can treat woods that are between approximately 6 and 200 mm in thickness. The duration of the treatment depends on the species and the thickness of the wood. Ovens can process between 2 300 000 and 4 000 000 board feet per year.

The treatment process consists in:

- Preheating the wood (temperature between 100 and 120°C);
- Drying the wood until the free water it contains is almost completely eliminated;
- Heating the wood (temperature between 200 and 230°C);
- Cooling the wood through a water vaporizing process and gas flow mixing in the treatment chamber.

The gases produced by the rise in temperature of the wood are re-injected into the combustion chamber in order to increase the temperature. If the energy supplied by the gases is not sufficient, propane or natural gas is also added.



# RESULTS

The results below are based on two (2) studies conducted by independent organizations. The first is entitled *Études sur le comportement physico-chimique du bois Perdure* by Forintek Canada and the second, *Caractérisation des émissions atmosphériques à la sortie du four de torréfaction de bois localisé à Dolbeau (Qc)*, was conducted by Consulair.

## Physical characteristics of Perdure wood

Heat treatment strengthens the wood's molecular bonds, improving its natural physical-mechanical properties. The nutritional elements in the wood degrade while water retention is significantly limited,

which makes the wood more resistant to fungal degradation and microorganisms (except termites).

The Perdure treatment also alters the hygroscopic properties of wood. Once treated, the humidity of the wood drops to between 1 and 3% and the wood itself becomes hydrophobic as its dimensional stability is increased.

Tests have also shown that the Perdure treatment makes the wood as resistant to fungal degradation as chemically treated (CCA) wood.

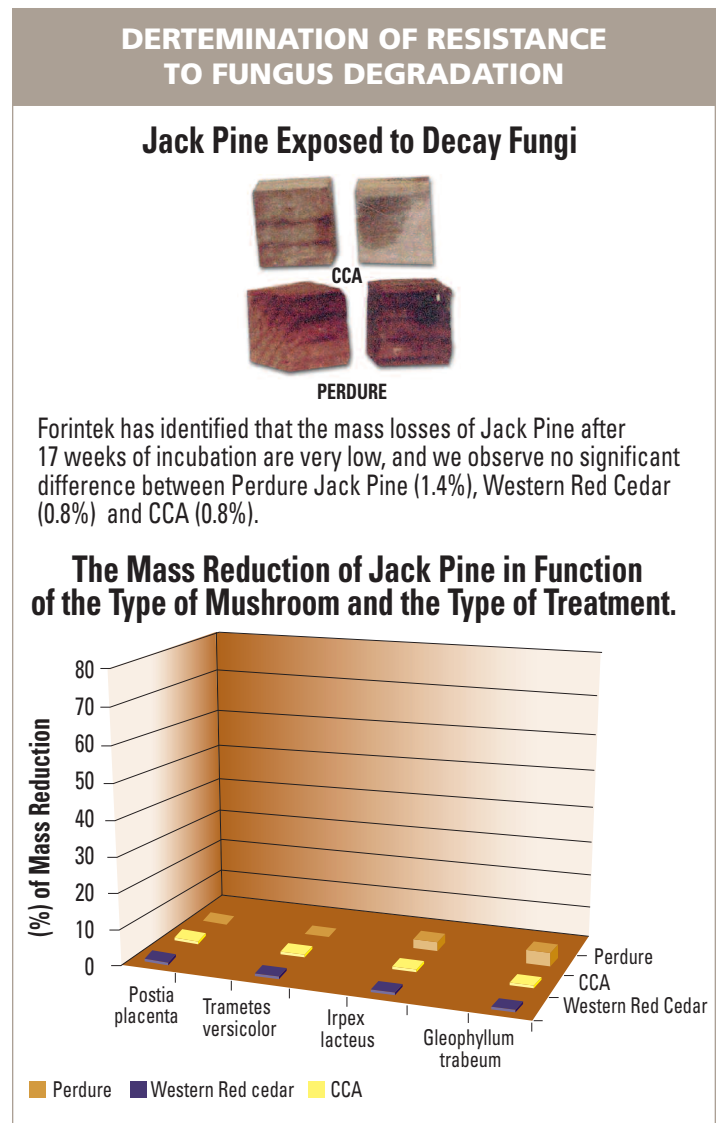
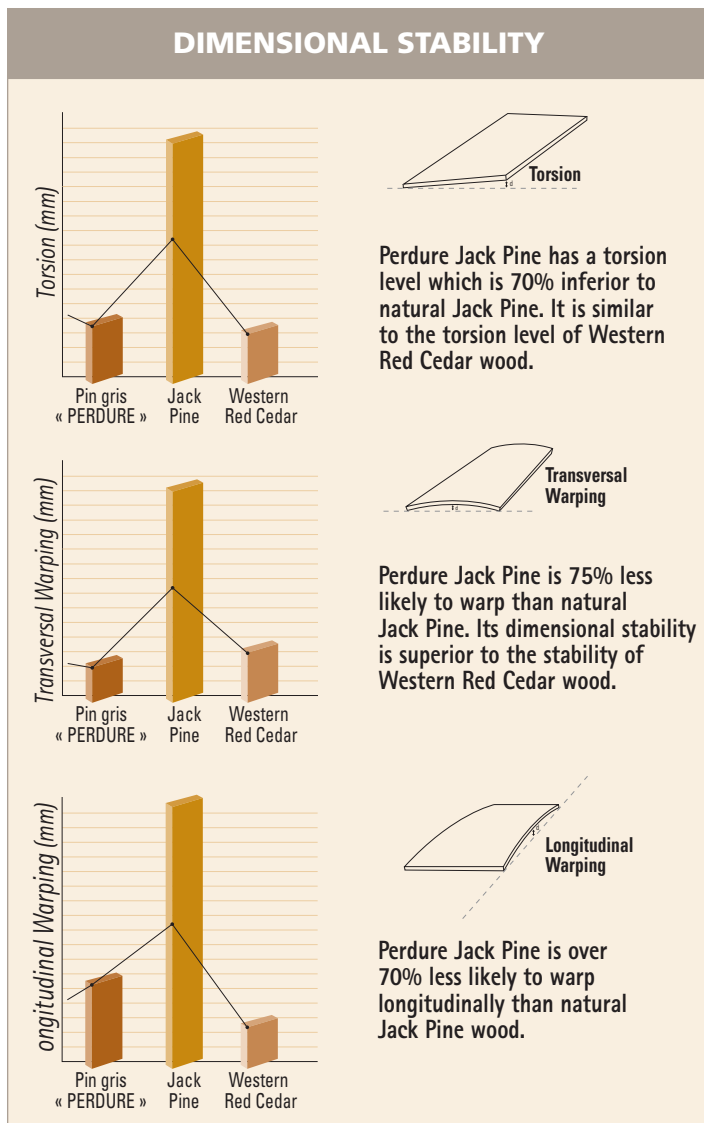
## Leachate

The high temperature treatment process generates a limited quantity

of liquid waste (4 litres per cycle following the post-treatment process, which amounts to 2 560 litres annually for the plant in St-Ambroise).

## Atmospheric emissions

The process generates mostly water vapour. Dioxins, furans, polycyclic aromatic hydrocarbons, phenolics, particulate matter, phenol, methanol, formaldehyde, methyl ethyl keton (MEK), gaseous organic compounds, carbon monoxide, oxygen and carbon dioxide emission analyses showed that there were almost zero or negligible atmospheric emissions.



# POTENTIAL AND LIMITATIONS

## Potential

- Constitutes an ecological alternative to wood treatment (the process does not involve the use of any chemical agents whereas a typical CCA retention level in chemically treated wood is 4.0 to 12.8 kg/m<sup>3</sup>);
- Treats all species of wood;
- Effective on species that are difficult to treat with conventional treatments;
- Produces exotic wood substitutes at a lesser cost;
- Increases the market value of less commonly used species (Jack pine, for example);
- Possibility of reclaiming the leachate for use by the nutraceutical and pharmaceutical industries (a study is currently underway).

## Limitations

- Depending on the species selected, Perdure wood could cost more than chemically treated wood;
- The durability of heat-treated wood does not extend to its use in contact with the ground. (permanently moist conditions).

- The wood may have to be dried artificially before beginning the process;
- The potential use of Perdure wood for structural end-uses must be examined further.
- Treatment does not protect the wood from ultraviolet radiations.

## INFORMATION

To develop and market the Perdure technology, PCI Industries Inc. received the financial and/or technical support of Canada Economic Development and the ministère du Développement économique, de l'Innovation et de l'Exportation, through its technology showcase program.

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