Phytosanitary Heat Treatment of Solid-Wood Products (an update)

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This presentation is intended to provide an overview of the current situation with regard to technology and policy as related to heat treatment of solid-wood products. A brief background on the development of HT programs is followed by a summary of the options available for Canadian companies. One of the more recent changes in this area is related to a wider range of wood products that must be assured to be pest free.

The IPPC (International Plant Protection Convention) defines a “Quarantine Pest” as: *“A pest of potential economic importance to the area endangered thereby and not yet present there, or present but not widely distributed and being officially controlled.”* In the early 1990s that pest was the pinewood nematode (PWN) and it’s vector the sawyer beetle (Monochamus).

Background

To address the threat posed by the PWN, Canada initiated a research program to identify an effective heat treatment and methods of achieving and verifying that in an industrial environment. This resulted in the development of the 56°/30 program (achieving 56° C. in the core of the wood for 30 minutes) which subsequently became the accepted standard for softwood lumber and other solid-wood products being traded in the international marketplace. Specifically, 56°/30 was accepted for softwood lumber exports from North America to Europe and it eventually became accepted as a recommended treatment for wood packaging under ISPM No. 15.

HT Options

Originally, the only way for a mill to participate in the HT program was to have each chamber (kiln) tested and verified that 56°/30 was achieved as part of either a standalone heat treatment or combined with a kiln drying process. This involved extra cost that mills needed to absorb. The process of heat treatment is not a “value-adding” operation and mills could not realistically recover the cost of this step. Over time, there

was pressure to develop a wider range of more easily implemented and cheaper options.

Generic Schedules Option

Experience and data collected from certifying individual kilns allowed the development of a series of “generic” heat treatment schedules. These were schedules that had been shown to achieve 56°/30 for a wide range of kiln types and wood products. The schedules are linked with a number of “operating conditions” that mills need to meet in order to take advantage of these options. Over time we have developed a wide range of generic schedules to heat treat softwood and hardwood products from 1-inch up to 12-inches thick and for both green and dry material. As an example, the generic schedules for 1,2, and 3-inch thick softwood lumber are listed in Table 1. These schedules provide a lower cost way for mills to participate in the heat treatment program. However, the original program of chamber by chamber certification still provides the shortest treatment time for a given product and facility. Mill operators now have the choice to use one or the other or a combination of both of these two operating methods.

Table 1. Summary of heat treatment times based on generic schedules for softwood lumber from CFIA document PI-07 (Technical Heat Treatment Guidelines and Operating Conditions Manual).

Maximum Thickness Inches (mm)	Minimum Total Treatment Time	Time with wet-bulb temp. ≥ 140° F (°C)	Final wet-bulb Temperature °F (°C)
2 ¼ (60)	6 hrs., 26 min.	2 hrs., 3 min.	145° (63°)
3 ¼ (85)	7 hrs., 20 min.	3 hrs., 20 min.	151° (66°)
4 ¼ (110)	10 hrs., 57 min.	6 hrs, 34 min.	153° (67°)

Site Specific Schedules Option

By comparison a site-specific schedule is a series of steps stipulating dry and wet-bulb temperatures that must be achieved at specific time intervals. The schedules are developed by monitoring the core wood temperature in a statistically significant number of samples placed in the “cold spot” of the kiln. The cold spot is determined by a thorough analysis of air temperature variability throughout the chamber. This two-part process results in schedules that are both safe (from a phytosanitary standpoint) and as efficient (in terms of treatment time) as possible. Site-specific schedules will therefore still be of interest and benefit to mills that are heat treating large volumes of material.

Other situations where site-specific schedules are required is when treating products that are not covered by one of the generic schedules.

FPInnovations has been involved in the development of site-specific schedules for a number of products and/or chambers that could not be covered by the generic schedules. We have conducted tests to demonstrate the conditions under which a superheated steam vacuum drying chamber could be used to heat treat large-diameter poles. We have also worked with one manufacturer to verify that a RF-heated chamber could achieve the required core temperature in large-dimension timbers.

Adapting/Developing Programs for Non-Lumber Applications

Some time ago, wood packaging was identified as a high-risk product for transmission of unwanted pests and the international community put in place measures to protect against that. The document ISPM No. 15 by the FAO (Food and Agriculture Organization of the United Nations) identifies heat treatment, to 56° C. for 30 minutes, as an option for wood packaging materials. Many types of wood packaging fall within the limitations of the generic schedules discussed above. Therefore, in many cases, wood packaging operations are able to use those options to heat treat wood packaging. One of the chief concerns with heat treating wood packaging is how the material is loaded into the treatment chamber. In particular the material must be piled to ensure there are no cross-sections of single pieces or pieces in close contact that exceed the thickness limitation for the schedule. When these conditions cannot be met, then a site-specific schedule is required.

Firewood is not traded extensively on the international scene (i.e. continent to continent) but there are concerns with moving it from one region to another. Since firewood has bark present it is an ideal habitat for wood-boring pests. One such pest is the emerald ash borer, a non-native pest that has been found in a number of locations in the north eastern U.S. as well as southern Ontario and Quebec. To guard against (or slow down) wider spread of this pest regulations have been put in place on the movement of firewood both between Canada and the U.S. as well as between regions within each country. Again heat treatment is an option available to make the wood safe for movement. The stipulated heat treatment for softwood firewood is 56° C. for 30 minutes whereas, the U.S, has requested a slighter higher time and temperature of 60° C for 60 minutes for hardwood (core wood temperatures).

Firewood presents some unique challenges for heat treatment. For one, the size is not uniform from piece to piece. The second challenge is the manner in which it is piled

and placed into the treatment chamber. Most wood products can be piled to provide airflow over several surfaces. Firewood, on the other hand, does not lend itself well to being piled in an organized fashion. As a result, all of the treatment schedules that we have developed in Canada have been site-specific schedules based on extensive testing at each mill.

Treatment Chambers

Initially virtually all chambers used to heat treat wood products were existing dry kilns. More recently, equipment manufacturers have responded with equipment that addresses the needs of this end use application. Despite the type of equipment there are some basic characteristics that are desirable for rapid and uniform heat treatment. The major ones are as follows:

- High and uniform airflow
- Uniform temperature distribution
- Well sealed
- Large heating capacity
- Humidification system

Several of the above characteristics are there because they are helpful in achieving or maintaining a high humidity, and therefore a high wet-bulb temperature, during the treatment. When green wood is being heat treated, the wet-bulb temperature is a limiting factor. The wood temperature will approach and closely follow the wet-bulb temperature until the wood approaches the fibre saturation point (25 to 30% MC). When the chamber is operated at a low RH, more drying takes place which in turn slows the heating rate of the wood.

Summary and Resources

Heat treatment as a phytosanitary treatment is now well established in Canada and around the world. Programs are in place in many countries. Canada has a long history in this area and, as a result, we have numerous options available to industry. The options cover a wide range of material sizes and conditions as well as a variety of equipment types. FPInnovations is available to provide on-going support to industry and government through continued research in this area as. We are also able to provide technical support to the industry when help is needed to develop site-specific procedures or address unique situations.

Information related to policies, certification of facilities, and international standards can be obtained from the following sources:

- CFIA (www.inpsection.gc.ca)
- Grading Associations/CLSAB (www.clsab.ca)
- Canadian Wood Pallet and Container Association (www.canadianpallets.com)
- IPPC (ISPM-15) (https://www.ippc.int/)

If FPInnovations can be of assistance you can contact the author at peter.garrahan@fpinnovations.ca or refer to our website at www.fpinnovations.ca for further contact information.