PREDRYING OF SPECIES CONTAINING WET-POCKETS

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Background

Pre-drying prior to kiln drying is a process that is followed for many hardwood species, to ensure that moisture specifications are met with minimum degrade and close uniformity is maintained within and between samples.

With the decline of the lumber supply and with the demand for added value products, softwood species are now readily utilized, even those containing wet pockets. The species containing "wet pockets" are difficult to kiln dry and poses added hardship in meeting tight moisture tolerances required for added value products. Therefore, new strategies for improving uniformity during kiln drying are now being pursued.

This study was designed to gain insight into the drying pattern of "wet pockets" and to evaluate whether pre-drying prior to kiln drying will result in a uniform moisture content of the lumber. Several mills on the Coast and the Interior of British Columbia believe that this two-stage drying process will alleviate their difficulties in meeting moisture specifications. A single wet pocket, if randomly selected, could cause rejection of the entire charge of lumber.

Pre-drying criterion for this study is defined as the room temperature conditions in the laboratory (70°F and relative humidity 52%) with an air flow of 100 fpm.

Objectives

The objectives of this study were the following:

(1) To determine the effect of pre-drying on the initial moisture content of wet pockets.

(2) To evaluate the drying rates of the "wet pockets" when (a) left within the normal wood, (b) when cut out of the normal lumber.

(3) To predict the best strategy to ensure moisture specifications are met with close uniformity within and between samples.

Materials and Method

One hundred specimens each of alpine fir (*Abies Lasiocarpa*) western hemlock (*Tsuga Heterophylla*), western red cedar (*Thuja Plicata*) were collected for this experiment. The specimens were rough green 2-inch by 6-inch by 12-foot. Western hemlock and western red cedar were obtained from the Coast and the alpine fir from the Interior of British Columbia. The specimens were collected at the green chain and met the following specifications:

(a) Each specimen contained at least two wet pocket sections

(b) The wet spot sections were approximately the same area

(c) The wet pockets were mapped

(d) The species of each specimen was identified

(e) Each species was collected to ensure the specimens came from the same log supply

Each 12-foot long sample was labelled and taken to the carpenter shop where 4" blocks were cut, two containing the wet pockets and one a control (Figure 1).

The specimens cut from each board were labelled, wrapped in plastic to prevent loss of moisture and taken to the university laboratory for analysis. They were weighed, stickered with 1/2" sticks and left under laboratory

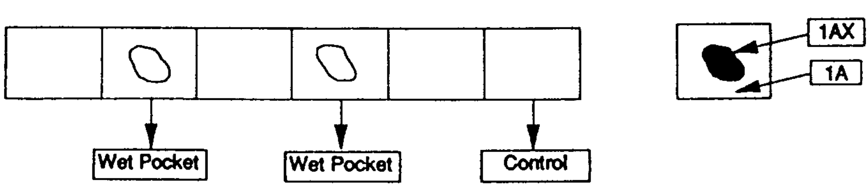

FIGURE 1. Cutting pattern for samples. A and B represent samples with wet pockets. C designates sections with no wet pockets. 1A was taken and the wet pockets cut away so the A sections yielded two specimens, A and AX.

conditions for one year. For the two weeks they were weighed every day and then once per week. After one year, all the specimens were oven dried and the moisture content calculated for each section.

The laboratory conditions were monitored constantly by a hygrothermograph to indicate the air temperature and the relative humidity. A small fan was used to generate an air flow of 100 fpm. Table 1 tabulates the average monthly conditions under which the specimens were subjected. The laboratory conditions were relatively constant and the fluctuation was ± 1 °F.

Results and Discussion

Behavioral Pattern of Wet Pockets

The behavioral pattern of the wet pockets within the normal wood and when cut away from the surrounding showed little difference in their ability to lose moisture. Figure 2 gives the loss of moisture for a typical section for wet pocket section for the three species investigated.

TABLE 1. Average conditions in laboratory.

	Average Dry Bulb (°F) (28 Days)	RH (%)
February 1993	70	52
March	69	53
April	70	52
May	68	52
June	70	51
July	69	52
August	71	52
September	70	51
October	70	52
November	69	52
December	70	52
January 1994	70	54
February	69	52

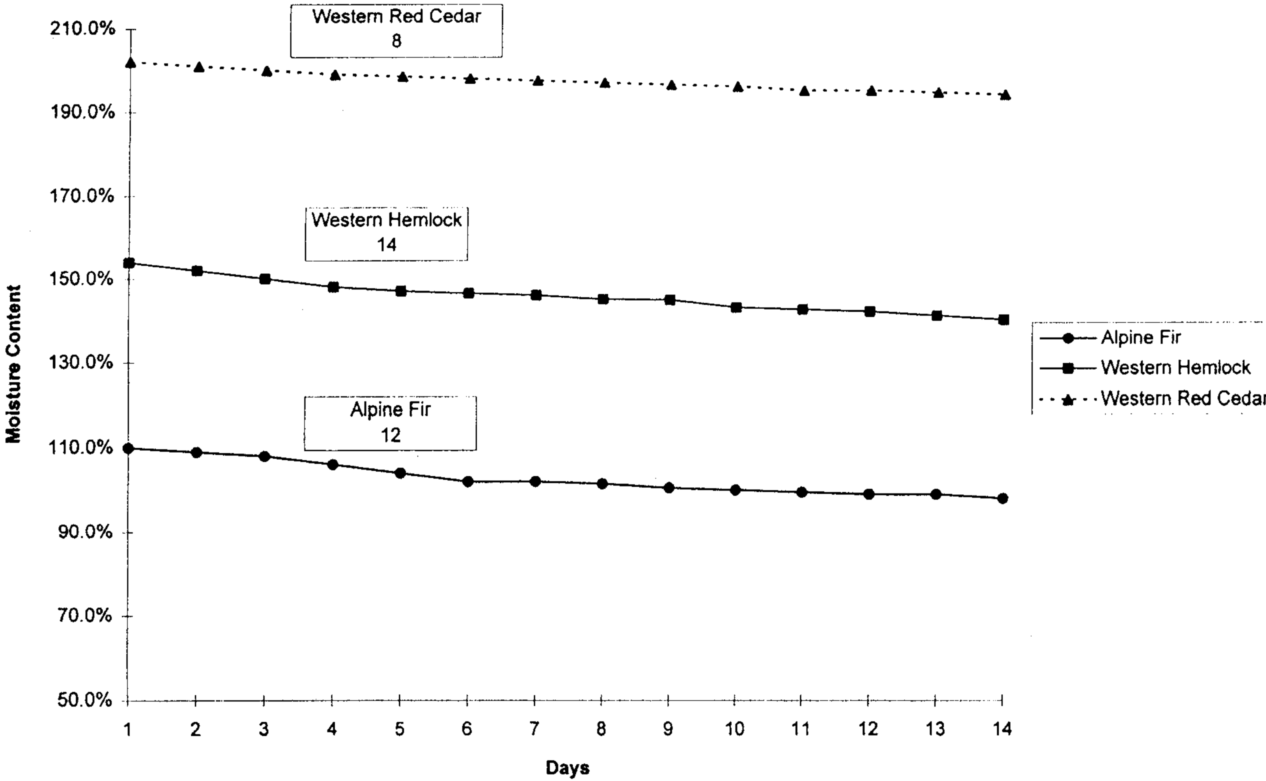

FIGURE 2. Moisture loss for a 2-week period of an individual sample (wet pocket).

The moisture content of the individual wet pockets sections for alpine fir, western hemlock and western red cedar were 110%, 154%, and 202% respectively. The losses in moisture content over a 14-day period were 12%, 14% and 8%. This indicates that the wet pockets have low permeability to internal moisture movement. This, perhaps, can be attributed to the plugging of the wood cells with bacterial slime. Earlier work indicates that bacterial attack in these regions will seal off aspirated pits thereby reducing moisture movement. The extractive content of western red cedar appears to further retard its ability to give up moisture.

Behavioral Pattern of the Normal Wood

Figure 3 shows the moisture loss of individual sections of normal wood for alpine fir, western hemlock and western red cedar. Each section started with an initial moisture content of 55%, 74%, 53% respectively and the moisture loss in the 14-day period was 16%, 20% and 14%. This result indicates that lumber without wet pockets would meet moisture specifications when kiln dried. As was noted in the study, the species alpine fir, western hemlock and western red cedar dried 25%, 30% and 42% faster than their wet pocket counterpart.

Some mills extend the residence time until the wet pocket sections are dried to the moisture specification. This results in over drying in the normal wood and the degrade is high due to shake, collapse, honeycomb and checking. In other cases, a redry scheme is followed where the wet pocket boards are selected after the kilning to be re-dried. The handling and drying cost is high. Recently, with the development of green moisture sorting, many mills are segregating the lumber into moisture content classes before drying. Green sorting appears to minimize the extremes in a given charge. Even with this process, these three species still lack uniformity because of the sapwood, heartwood wet pocket mix.

Behavioral Pattern over 12-Month Period (Wet Pocket, and Normal Wood Sections)

Table 2 shows the average moisture content losses of the normal wood and the wet pocket sections for a twelve-month period. The initial moisture content for alpine fir, western hemlock and western red cedar were 52%, 56% and 48% respectively. In 12 months of exposure, these three species achieved a final moisture content of 8%, 6% and 10%. The moisture losses were 85%, 89% and 79%.

The average moisture content of the wet pocket sections were 140% for alpine fir, 153% for western hemlock and 170% for western red cedar. In the 12-month period, a final moisture content of 50%, 68% and 40% was achieved. The drying losses were 35%, 44% and 23% respectively. These results indicated that the pre-drying rates of normal wood compared to wet pocket was twice as fast.

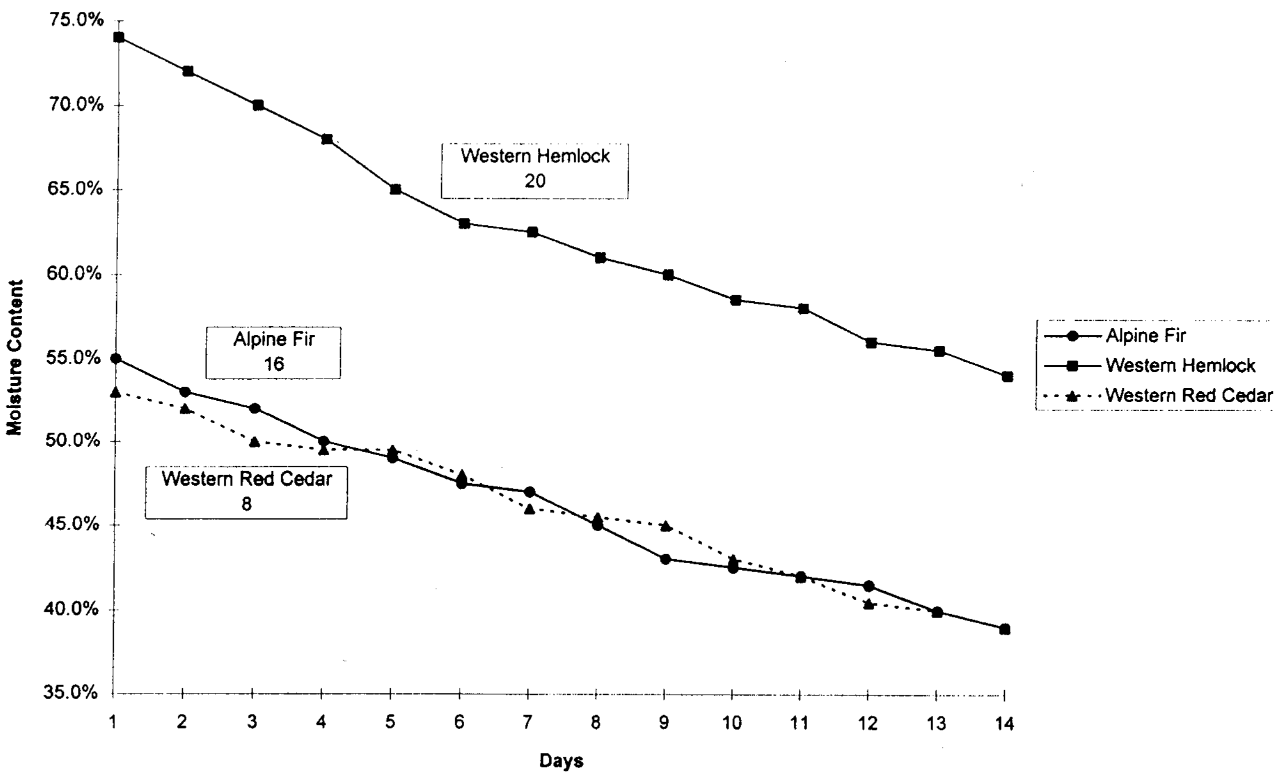

FIGURE 3. Moisture loss for a 2-week period of an individual sample (normal wood).

TABLE 2. Average initial and final moisture content of wet pockets and normal wood sections. Moisture loss is for a one-year period. Moisture lost as a percent of initial moisture is in parenthesis.

Species	Wood Type	Ave. Initial M.C.	Ave. Final M.C.	Total Moisture Loss (1 year)
Alpine Fir	Normal	52	8	44 (85)
	Wet Pocket	140	90	50 (35)
Western Hemlock	Normal	56	6	50 (89)
	Wet Pocket	153	93	68 (44)
Western Red Cedar	Normal	48	10	38 (79)
	Wet Pocket	170	130	40 (23)

The second observation was that in the first three to four weeks the wet pocket sections gave up moisture readily and for the rest of eleven months of exposure remained almost stagnant. The cells of these wet pocket regions appear to be semi-permanently sealed after a certain quantity of moisture is removed from the wood.

Initial Moisture Distribution of Normal and Wet Pocket Sections

Figures 4 and 5 show the initial moisture content distribution of normal wood and wet pocket sections for the three species studied. The minimum and maximum initial moisture content values for normal wood are (25, 60), (30, 70), (25, 65) and for wet pocket sections (90,180), (95, 175) and (125, 220).

The average drying times for 2 x 6 alpine fir, western hemlock and western red cedar dimension lumber are (32-44 hours.), 102 hours and (168-192 hours). These were the actual drying times at the lumber mills where the specimens were collected for this study (Table 3).

The analysis indicates that the permeability of wet pocket sections of these species must be determined if a strategy for an improved kiln scheduling is required by the industry.

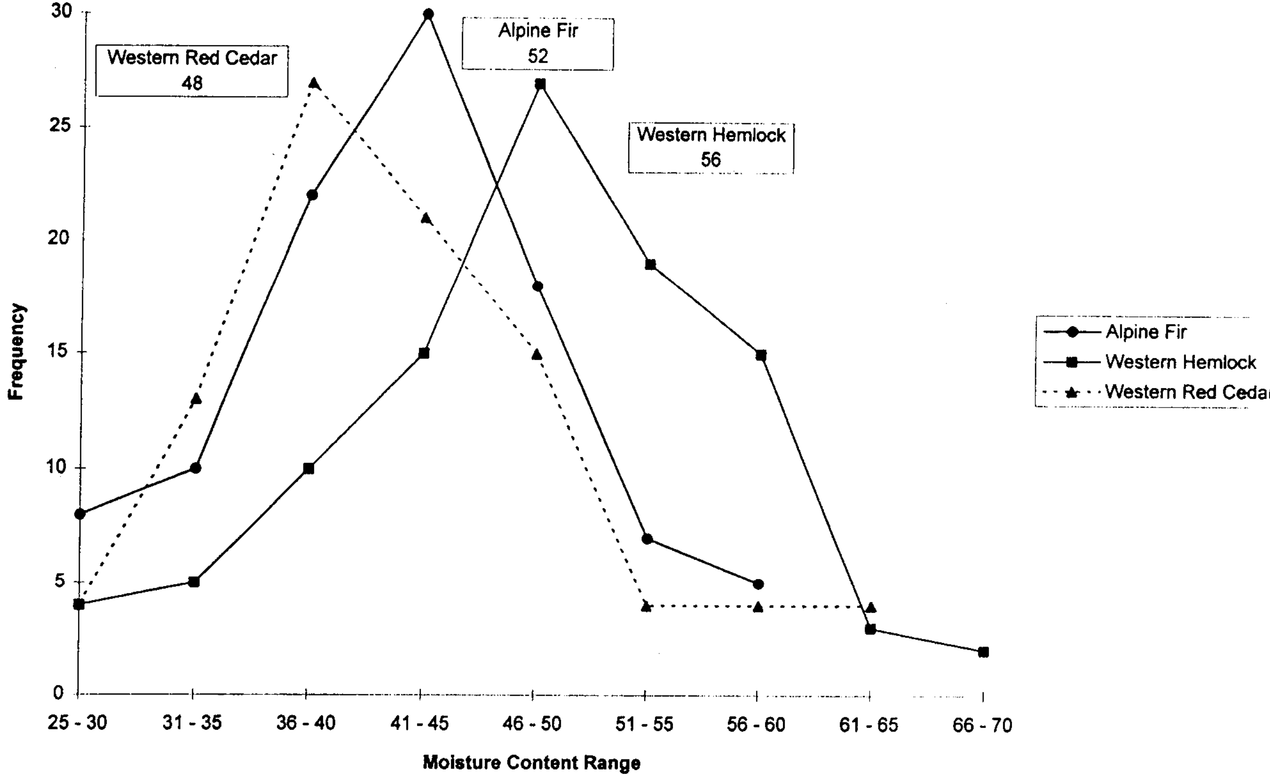

FIGURE 4. Moisture content distribution of normal wood.

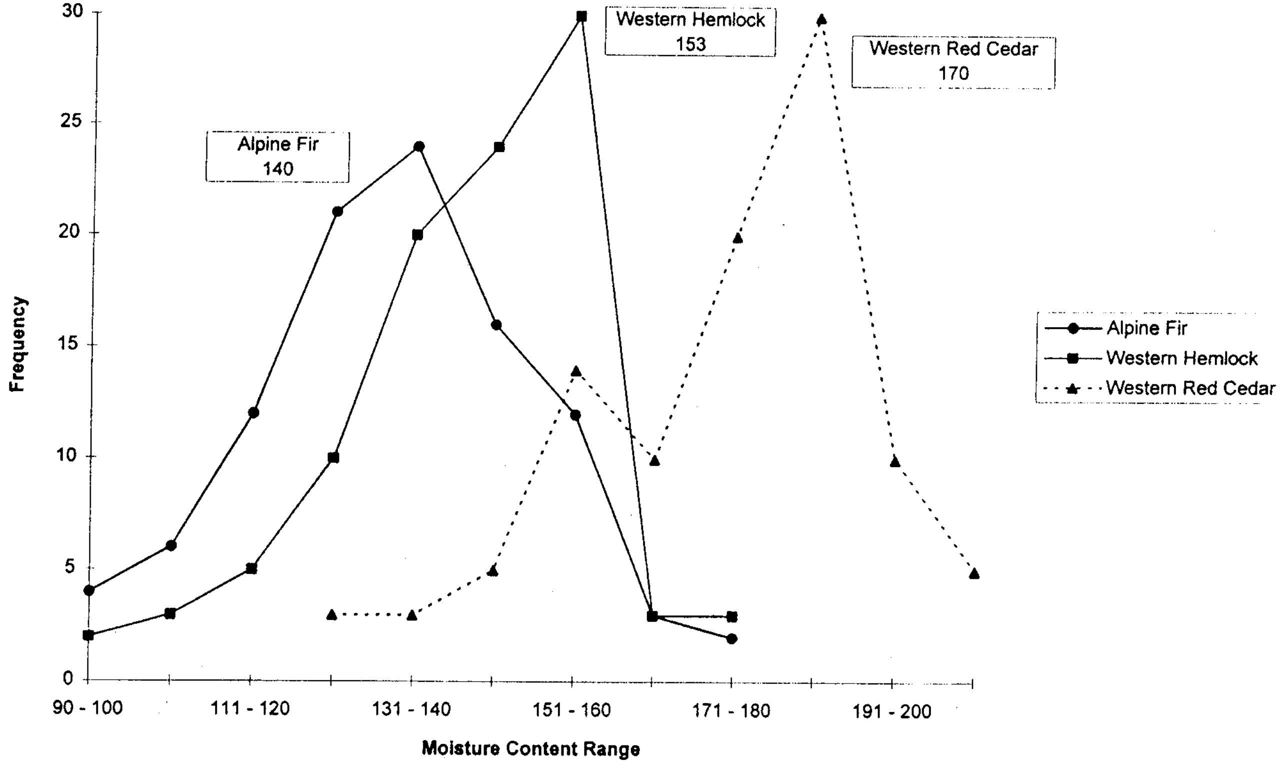

FIGURE 5. Moisture distribution of wet pockets.

TABLE 3. Actual drying times recorded for 2x6 lumber. Note this data collected from the mills where sampling was done. (Conventional schedule) common stock.

Species	Dimension	Final M.C., %	Drying Times
Alpine Fir	2 x 6	14 - 16	32 to 44 hours
Western Hemlock	2 x 6	15 - 16	102 hours
Western Red Cedar	2 x 6	12 - 15	7 - 8 days

Conclusion

This study was designed to improve the drying scheduling of these three species containing wet pockets. From the analysis, it has become apparent that further research is required to assess:

(a) the permeability of the wet pocket sections

(b) to ascertain the actual economical losses on lumber degrade due to wet pockets

This evaluation determined that pre-drying partially alleviates the moisture content differential between the wet pockets and the normal wood mix.

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