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October 26, 1994

Mr. John S.Cannon
President
Cannon Structures Inc.
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P.O. Box 1728
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Dear John:

Enclosed you will find five copies of our final report on the durability of Trestlewood in an accelerated laboratory soil block test.

As you will note, the results indicate that the presence of salt in the heartwood did not appear to markedly improve durability in comparison with previous trials of this species. Sapwood durability was generally improved, even when the specimens were subjected to a leaching procedure prior to exposure. I would caution against making much of this finding; however, since the fungal growth on the leached blocks was luxuriant, suggesting that these samples would eventually experience more substantial decay.

In the end, I think our tests would permit one to conclude that the Trestlewood is slightly more durable than normal Douglas-fir, particularly in the sapwood. This durability is temporal and the materials still must be protected with a conventional preservative in soil exposures where decay is likely to occur. One potential benefit of a more durable material, however, would be a diminished risk of internal decay once the product has been placed in service. This would be particularly useful for larger products such as bridge timbers, railroad ties or poles, where there is a large amount of untreated wood surrounded by a shell of treatment.

I hope you find the report of interest. As per our original agreement, please also consider this as an invoice for $650. This amount should be remitted to the OSU College of Forestry and sent to my attention.

Please give me a call if you have any questions concerning the results. We are planning to perform some additional analysis on the blocks to better quantify the salt content and, if the results appear valid, we may wish publish this as a note. If we proceed in this manner, we will provide a copy of the proposed manuscript for your review and comment.

We appreciate your interest in Oregon State and look forward to further cooperation.

Sincerely,

Jeffrey J. Morrell

NATURAL DURABILITY OF TRESTLEWOOD IN AN ACCELERATED LABORATORY TEST

FINAL REPORT

SUBMITTED TO

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INTRODUCTION

The recent attempts to salvage timbers and piling from the Southern Pacific railroad trestle crossing the Great Salt Lake have raised a number of questions concerning the durability of the salvaged materials which had been immersed in the lake for long periods.

Douglas-fir heartwood is normally classified as a moderately durable heartwood, meaning that it will provide reasonable performance above the ground (i.e. around 5 to 10 years in a moist climate), but will perform poorly in ground contact where moisture is present unless it is given a supplemental treatment (Scheffer and Cowling, 1966). The piling exposed to the lake have salt contents which reach up to 11 % by weight, a level which should limit microbial attack by many wood colonizing organisms (Zabel and Morrell, 1992); however, the eventual loss of these salts through normal leaching should markedly diminish any potential benefits of salt water exposure. In this report, we examine the decay resistance of Douglas-fir removed from the railroad trestle using an accelerated laboratory decay test as a means for predicting the benefits of prior salt immersion.

MATERIALS AND METHODS

Cross sections (2 to 4 inches thick) were cut from 10 randomly selected piles and shipped to Oregon State University. A series of cubes were cut from zones corresponding to the sapwood, the outer heartwood and the inner heartwood or pith. A total of 18 blocks were removed from each cross section, two per position at four cardinal locations around the section (Figure 1). One block from each position per section was leached according to the procedures described in American Wood Preserver's Association standard E10 in which the blocks were

submerged in an excess of distilled water, then a vacuum was drawn over the solution to impregnate the wood (AWPA, 1993). The water was then changed 6, 12, and 24 hours after soaking, then at 24 hour intervals for a 14 day period. Each block was weighed before and after leaching to determine weight losses associated with these treatments.

All blocks were then oven-dried (54 C) and weighed (nearest 0.01 g) prior to being placed in plastic bags which were then exposed to 2.5 mrads of ionizing radiation from a cobalt 60 source. The sterile blocks were used in an AWPA soil block test using Postia placenta as the test fungus. This fungus was chosen because it is a common inhabitant of Douglas-fir heartwood and is capable of causing substantial wood degradation under ideal conditions (Sexton et al., 1992).

Briefly, moisture forest soil was placed in 454 ml glass jars and a western hemlock feeder strip was placed on top of the soil. The jar was capped and autoclaved for 45 minutes at 121 C, cooled overnight, and autoclaved for 15 minutes at 121 C. The feeder strip was then inoculated with a disc cut from the actively growing edge of a culture of Postia placenta (Fries) M. Larsen et Lombard (Isolate ATCC 11538). The bottles were incubated until the fungus covered the feeder strip, then the blocks were added and incubated an additional 12 weeks at 28 C. The blocks were then removed, scraped clean of adhering mycelium and weighed prior to re-drying and weighing to determine weight lost during fungal exposure. The results were combined by position to provide approximate levels of durability of the sections. In addition, the total leaching losses and fungal weight losses for the leached blocks were combined to provide a measure of total weight loss from both procedures.

RESULTS AND DISCUSSION

Weight losses in leached blocks were markedly lower than those found in unleached blocks; however, fungal growth was substantially greater on the leached blocks (Table 1). This anomaly reflects the fact that weight losses associated with the unleached blocks include both the fungal decay component and a leaching component due to loss of salts as the blocks came in contact with the wet feeder strip. Blocks which were not leached experienced much lower levels of fungal attack as evidenced by the appearance of the wood.

Leaching produced wood weight losses which ranged from 5.6 to 29.3 % prior to fungal exposure reflecting the high salt content of the wood as well the ease with which such material can be removed (Table 1). Subsequent fungal exposure produced average weight losses ranging from 3.3 to 16.7 %. These values were relatively low, particularly for Douglas-fir sapwood. Previous trials with this wood species and fungus produced weight losses which ranged from 20 to 40 %. The exposure to salt and other materials clearly enhanced the durability of sapwood and this durability remained after leaching. Heartwood durability did not differ markedly from the sapwood, suggesting that the residual salts did not confer additional protection against fungal attack to the already moderately durable heartwood.

The results suggest that this material, owing to the range of weight losses encountered would still be classified as moderately durable. One advantage, however, of this material is the increased durability of the sapwood, which might prove useful wherever complete sapwood treatment with conventional preservatives was not possible or desirable. Douglas-fir heartwood is notoriously difficult to treat with preservatives and the residual protection afforded by prior salt immersion could help to mitigate these treatment difficulties, provided there is some treated shell surrounding the core of untreated wood.

LITERATURE CITED

American Wood Preserver's Association (AWPA). 1993. Standard E10-91. Standard method of testing wood preservatives by laboratory soil-block cultures. In: Book of Standards, AWPA, Stevensville, MD. 26 p.

Scheffer, T.C. and E.B. Cowling. 1966. Natural durability of wood to microbial deterioration. Annual Review of Phytopathology 4:147-170.

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