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PROCESS STANDARDS – DO THEY MAKE SENSE IN A POST-CCA WORLD?

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Summary

During the Summer of 2003, approximately 2,853 pure commodity charge reports for fence boards, 5/4 decking, 2x4 lumber and 2x6 lumber were collected from seven treating facilities spread across Canada, and analyzed for adherence to Timber Specialties Co. NatureWood® treating program. Information collected from the charge reports included: charge number, date, species, commodity type and volume, solution concentration and temperature, additives, treating cycle parameters, solution volume absorbed, and penetration and retention results. The collected information was also reviewed for support of the recently proposed process standard, CSA O80.36 "Preservative Treatment of Wood Products for Light-Duty Above-Ground Residential Uses by Pressure Processes".

The results of commodities treated according to Timber Specialties Co. NatureWood® treating program were similar to the requirements listed in the proposed CSA O80.36 standard. Approximately 0.61, 0.64, 0.53, and 0.56 imperial gallons of NW100 treating solutions were absorbed by each cubic foot of fence boards, 5/4 decking, 2x4 and 2x6 lumber commodities treated, respectively. Calculated gauge retentions were approximately 0.12, 0.13, 0.11, and 0.12 pounds of preservative actives per cubic foot of fence boards, 5/4 decking, 2x4 and 2x6 lumber commodities treated, respectively. The observed gauge retentions for these commodities are similar to those listed for the requirements of the proposed CSA O80.36 standard. However, slightly higher NW100 solution concentrations were required to achieve these gauge retentions.

Introduction

The Canadian Standards Association's (CSA) wood preservation standard CSA O80.2 "Preservative Treatment of Lumber, Timber, Bridge Ties, and Mine Ties by Pressure Processes" applies to the treatment of lumber and timber for use in aboveground, ground contact and freshwater applications. The waterborne preservative penetration requirement for the thin sapwood species of this standard was set at 10 mm and 90% of sapwood penetrated. Chromated copper arsenate (CCA) treating facilities found it impossible to consistently meet the 10 mm penetration target on a day-to-day production basis, especially if unincised SPF (spruce-pine-fir) decking lumber was being treated. So the CSA O80.2 standard was set aside and only occasionally referenced. Market forces dictated that decking lumber was unacceptable if incised, and SPF lumber was increasing in use for this application.

The CSA O80.32 standard "Preservative Treatment of Decking Lumber with Water-borne Preservatives by Pressure Processes" was developed in 1997 to address some of the treatment issues associated with difficult to treat and thin sapwood species used in residential aboveground decking applications. Studies had indicated that thin shell treatments were performing effectively in field testing, so the preservative penetration requirement for CSA O80.32 standard was set at 5 mm. Again, CCA treating facilities found it impossible to consistently meet the 5 mm penetration target on a day-to-day production of unincised SPF lumber. The resulting frustration in trying to meet the CSA standards, and failure to do so consistently resulted in lapsed quality assurance procedures at most CCA treating facilities, and the CSA O80.32 standard was again set aside and only occasionally referenced.

Table 1: Specific Requirements of the Proposed CSA O80.36 Standard

	Western Red Cedar	**Hem-Fir, Spruce Pine Fir, Coastal Douglas Fir**
Treatment Conditions		
Preconditioning or post-treatment conditioning.		
Kiln conditioning	Required for Group B only	Required for Group B only
Time, minutes at core temperature, C	30 at 56C or 1 at 70C	30 at 56C or 1 at 70C
Moisture Content Prior to Treatment		
Maximum, %	30	30
Initial vacuum		
Minimum at sea level, kPa	25	25
Incising	Not required	Not required
Treatment Pressures		
Minimum kPa	340	520
Maximum kPa	680	1040
Period Above Minimum Pressure (Minimum time, minutes)		
Group A	15	15
Group B	60	60
Solution Temperatures (Minimum C)		
ACQ-B	15	15
ACQ-C	20	20
CA-B	20	20
Solution Strengths (Minimum %)		
ACQ-B (Cu as oxide, Quat)	1.8	1.8
ACQ-C (Cu as oxide, Quat)	1.8	1.8
CA-B (Cu as metal, Azole)	0.8	0.8
Results of Treatment		
Retention by Gauge (Minimum kg/m3)		
ACQ-B (Cu as oxide, Quat)	2	2
ACQ-C (Cu as oxide, Quat)	2	2
CA-B (Cu as metal, Azole)	0.9	0.9
Re-drying After Treatment if Required		
Max. permissible kiln temperature C	75	75

Recently, a process standard, CSA O80.36 "Preservative Treatment of Wood Products for Light-Duty Above-Ground Residential Uses by Pressure Processes" (Table 1) has been brought before the CSA O80 technical committee by Dr. Paul Morris, Forintek Canada Corp. This standard was designed to address some of the treatment issues associated with wood products such as SPF decking that cannot be incised. However, this standard is lacking commercial treatment data for validation. The CSA O80.36 standard is currently making its way through CSA's standardization process and will probably be published in mid 2004. It is yet to be seen how treating facilities will react to this new standard given the history of CCA usage and CSA standards.

In 2002, Timber Specialties Co. established the NatureWood® treating program for production of NW100 ACQ-C (amine copper quat) preservative treated products sold in stores across Canada. Adherence to the NatureWood® treating program requires that treating facilities conduct treatments in accordance with the NatureWood® standard (Table 2). The NatureWood® standard is defined by minimum treatment requirements for boards, lumber and timber commodities, and is broken into above-ground and ground contact applications. Fence boards, 5/4 decking and 2x4 lumber commodities are treated according to defined process parameters where the determination of penetration and assay retention are not required. The determination of penetration and assay retention is however, required for all other 2", 4", and 6" lumber and timber commodities. Except for 2x6 lumber, penetration and assay retention are determined according to CSA O80.2. The penetration and assay retention for 2x6 lumber is determined according to CSA O80.32. The aim of this report is to provide commercial treating results in support of process-type preservative treatment standards such as the NatureWood® standard and CSA O80.36.

Methodology

During the Summer of 2003, approximately 7,598 charge reports for commodities treated according to the NatureWood® standard were collected from seven treating facilities spread across Canada, and analyzed for adherence to the NatureWood® treating program. Information collected from the charge reports included: charge number, date, species, commodity type and volume, solution concentration and temperature, additives, treating cycle parameters, solution volume absorbed, and penetration and retention results. The information collected from the charge reports will be used to create a data base in support of the development of future NatureWood® and CSA standards. In order to eliminate the influence from mixed commodity charges, approximately 2,853 pure charges for fence boards, 5/4 decking, 2x4 lumber and 2x6 lumber were selected and analyzed for this report.

Results and Discussion

Some of the key variables that may affect preservative treatment quality are listed in Table 3. Close attention should be paid to the wood, solution, and process variables in the treating facilities quality assurance procedures. The success of process-type standards is dependent on good quality control practices.

Table 2: Specific Requirements of the NatureWood® Standard

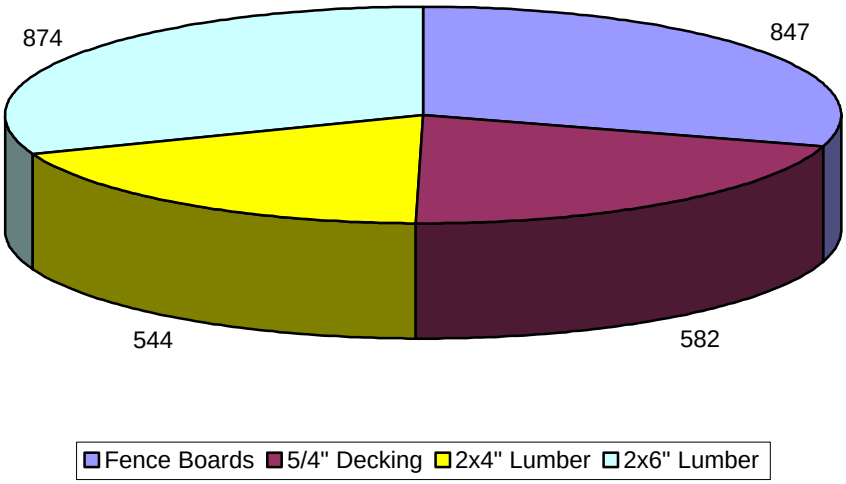
Commodity		Treatment Requirements[3]							Penetration & Retention Requirements[6]	
		M.C. %	Incising	Initial Vacuum @ 22" Hg	Minimum Pressure Time	Minimum NW 100	Water Repellent	Mold Inhibitor		
Above-Ground Use	Fence Boards	S-Grn[1]	N/R	10 min.	30 min.	1.8%[4]	2.00%	30 ppm	N/A	
	2X4 and 5/4" Decking	S-Dry	N/R	30 min.	60 min.	1.8%[4]	2.00%	30 ppm	N/A	
	2x6 Lumber	S-Dry	May be Required	30 min.	60 min.	2.0%[5]	N/A	30 ppm	3/16" and 90% sapwood 0.40pcf	
	Lumber 2x8 and Greater	S-Dry[7]	Required	30 min.	90 min.	2.0%[5]	N/A	30 ppm	3/8" and 90% sapwood 0.25 pcf	
Ground Contact	4X4 / 6X6 and Greater • Red Pine • Ponderosa Pine • White Pine	S-Grn[2]	May be Required	30 min.	60 min.	2.0%[5]	N/A	30 ppm	4X4	6X6 and Greater
									3/8" and 90% sapwood 0.40 pcf	1/2" and 90% sapwood 0.40 pcf
	4X4 / 6X6 • All Other Species	S-Grn[2]	Required	30 min.	120 min.	2.0%[5]	N/A	30 ppm		

1. M.C. % at the time of treatment must be adequate to allow proper penetration.
2. M.C. % at the time of treatment must be low enough to meet the required penetration and retention.
3. Chart recorder or computer must be used to verify all pressure/vacuum cycles.
4. Solution temperature must be maintained between 75°and 100° F.
5. Solution temperature must be maintained between 90°and 110° F.
6. Sample every charge for penetration and retention.
7. Hem-fir lumber may be S-Grn provided it meets penetration and retention requirements.

Table 3: Key Variables Affecting Preservative Treatment Quality

Wood Variables	Solution Variables	Process Variables
Species	Concentration	Accurate Record Keeping
Heartwood / Sapwood ratio	Additives	Accurate Gauges
Moisture Content	Dirt	Initial Vacuum - level & duration
Quality of Drying	Temperature	Pressure - level & duration
Temperature		Final Vacuum - level & duration
Dirt		

Figure 1: Distribution of Pure Commodity Charges Treated with NW100

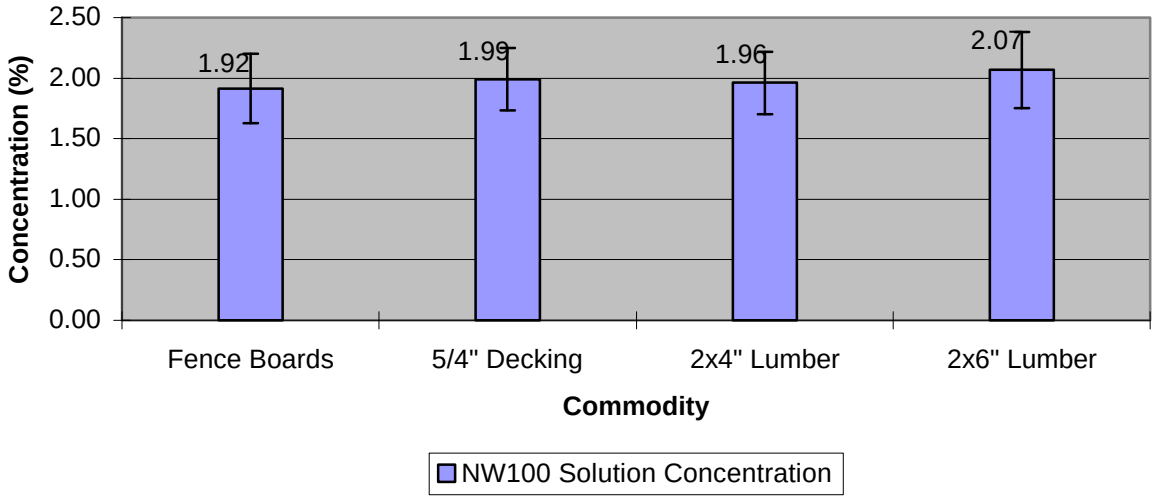


The commodity distribution of the pure charges of fence boards, 5/4 decking, 2x4 and 2x6 lumber is shown in Figure 1. The predominant species group that was listed on charge reports for each commodity was SPF. Approximately 855 pure charges of fence boards, 582 pure charges of 5/4 decking, 544 pure charges of 2x4 lumber and 874 pure charges of 2x6 lumber were analyzed. The analysis of pure commodity charges eliminates the potential effects from mixed commodities and any influences on preservative treatability.

The NW100 treating solution concentrations that were used in the treatment of the charges of fence boards, 5/4 decking, 2x4 and 2x6 lumber are shown in Figure 2. On average a 1.92% NW100 solution concentration was used to treat the fence boards; a 1.99% NW100 solution concentration was used to treat the 5/4 decking, a 1.96% NW100 solution concentration was used to treat the 2x4 lumber, and a 2.07% NW100 solution concentration was used to treat the 2x6 lumber commodities. NW100 solution concentrations are reported as total actives (copper oxide plus quat). Treating facilities targeted a 2% NW100 treating solution for the treatment of most commodities.

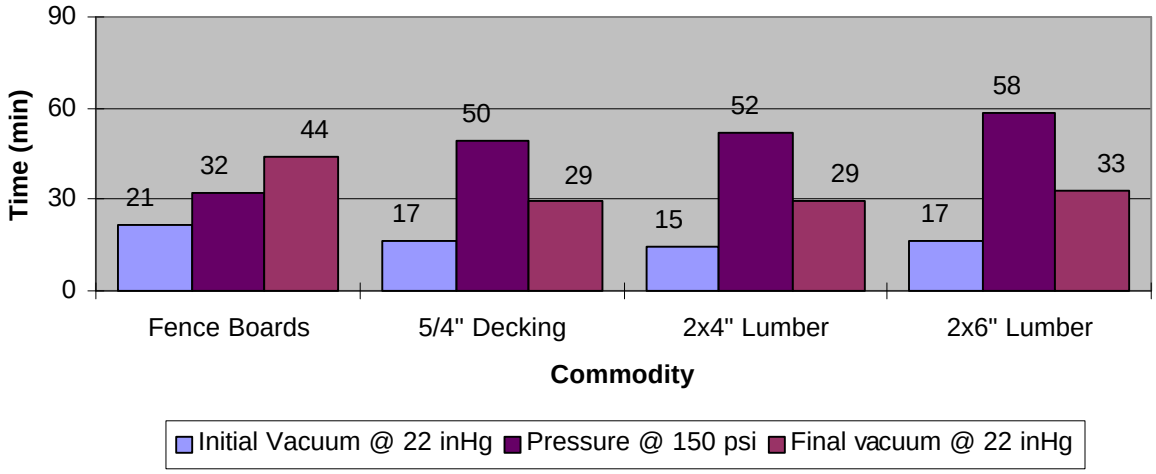
The treating cycle parameters used in the treatment of fence boards, 5/4 decking, 2x4 and 2x6 lumber are shown in Figure 3. The average treatment cycle for fence boards was 21 minutes initial vacuum at 22 inHg followed by a 32 minutes pressure period at 150 psi and 44 minute final vacuum at 22 inHg. The average treatment cycle for 5/4 decking, 2x4 and 2x6 lumber was about 16 minutes initial vacuum at 22 inHg followed by about 53 minutes pressure at 150 psi and about 30 minutes final vacuum at 22 inHg. According to the NatureWood® standard, target initial vacuum and pressure periods were 30 and 60 minutes, respectively, for most commodities.

Figure 2: NW100 Solution Concentrations used to Treat Lumber Commodities



The resulting NW100 treating solution absorptions and gauge retentions for the charges of fence boards, 5/4 decking, 2x4 and 2x6 lumber are shown in Figure 4. Solution volumes are reported in imperial gallons. Approximately 0.61 imperial gallons of NW100 treating solution was absorbed by each cubic foot of fence boards treated. Approximately 0.64, 0.53, and 0.56 imperial gallons of NW100 treating solutions were absorbed by each cubic foot of 5/4 decking, 2x4 and 2x6 lumber commodities treated, respectively. Based on the NW100 treating solution concentrations and absorption volumes, the gauge retentions calculated were approximately 0.12, 0.13, 0.11, and 0.12 pounds of preservative actives per cubic foot of fence boards, 5/4 decking, 2x4 and 2x6 lumber commodities treated, respectively. The observed gauge retentions for these commodities are similar to those listed for the requirements of the proposed CSA O80.36 standard. However, slightly higher NW100 solution concentrations were required to achieve these gauge retentions.

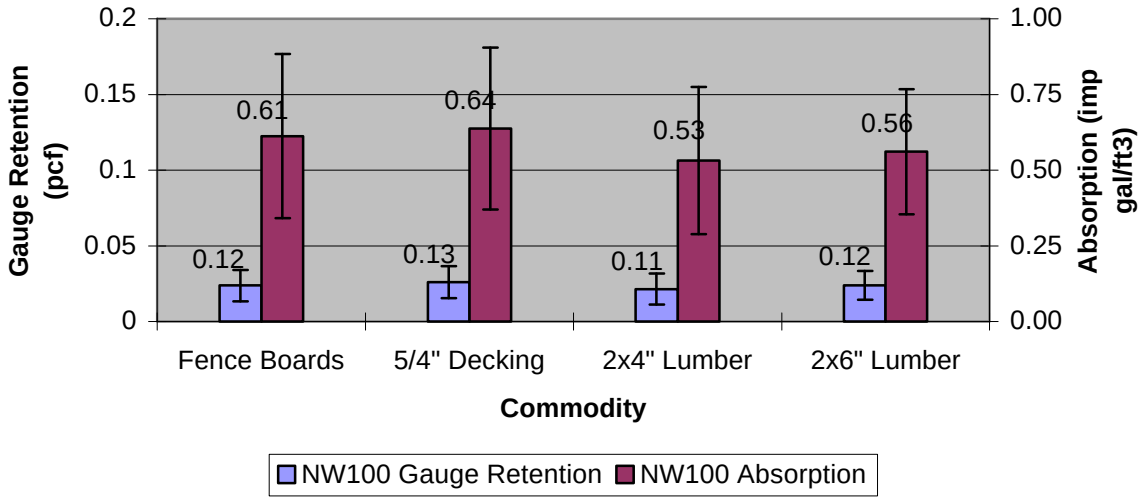
Figure 3: Treatment Cycles used for Treating NW100 Lumber Commodities



The NW100 solution absorption rates were selected to compare mean differences between commodity treatments. A graphical representation of Tukey's multiple comparison test for NW100 solution absorption rates is shown in Table 4. There are no statistically significant differences (0.05 level of significance) between the NW100 absorption rates for 2x4 and 2x6 lumber commodities. There are also no statistically significant differences between the NW100 absorption rates for fence boards and 5/4 decking commodities. However, the NW100 absorption rates for fence boards and 5/4 decking are statistically different than the NW100 absorption rates for 2x4 and 2x6 lumber commodities. Based the above statistical analysis, 5/4 decking and 2x6 lumber commodities could be sampled for penetration and retention results and used to build a database in support of preservative treatment quality based on gauge retentions. This would be similar to the approach taken by Timber Specialties Co. in the development of their NatureWood® standard.

The upper and lower 95% confidence intervals for each commodity absorption rate are also presented in Table 4. The 95% confidence intervals can be used to more clearly define the NW100 solution absorption range for each commodity and can be used in the development of quality control procedures.

Figure 4: Solution Absorptions and Gauge Retentions for Lumber Commodities Treated With NW100



Conclusion

The results of commodities treated according to Timber Specialties Co. NatureWood® treating program closely relates to the requirements listed in the proposed CSA O80.36 standard. However, slightly higher solution concentrations were used to treat commodities in the NatureWood® treating program. The application of the O80.36 process standard will require strict adherence to the parameters set out in the standard. Treating facilities will need to take the necessary precautions to ensure that wood, solution, and treating process variables are optimized in order to ensure predictable product treatment quality. The treating facility will also need to develop and adhere to strict quality assurance procedures in order to ensure and maintain product quality. The collection and analysis of information such as presented in this report could be used to help ensure day-to-day production quality of the treated products.

Preservative treatment process standards do make sense, but only if they are properly administered and monitored.

Table 4: Tukey's Multiple Comparison Tests for NW100 Absorption Differences

Commodity	2x4 Lumber	2x6 Lumber	Fence Boards	5/4 Decking
Average NW100 Absorption (Imp gal/ft^3)	0.532	0.561	0.613	0.637
Lower 95% Confidence Interval	0.511	0.547	0.595	0.615
Upper 95% Confidence Interval	0.552	0.575	0.631	0.658

Average absorption of any two groups underscored by the same line are not significantly different at alpha = .05

Literature Reviewed

CSA O80. 1997. *Wood Preservation Series*. Canadian Standards Association. Rexdale, ON.

CSA O80.36. 2003. Preservative treatment of wood products for light-duty above-ground residential uses by pressure processes. Proposed standard submitted to the Canadian Standards Association's technical committee on wood preservation.

NatureWood® Standard. 2002. Standard for the production of premium cut NatureWood® NW100 preserved wood. Timber Specialties Co. Campbellville, ON.