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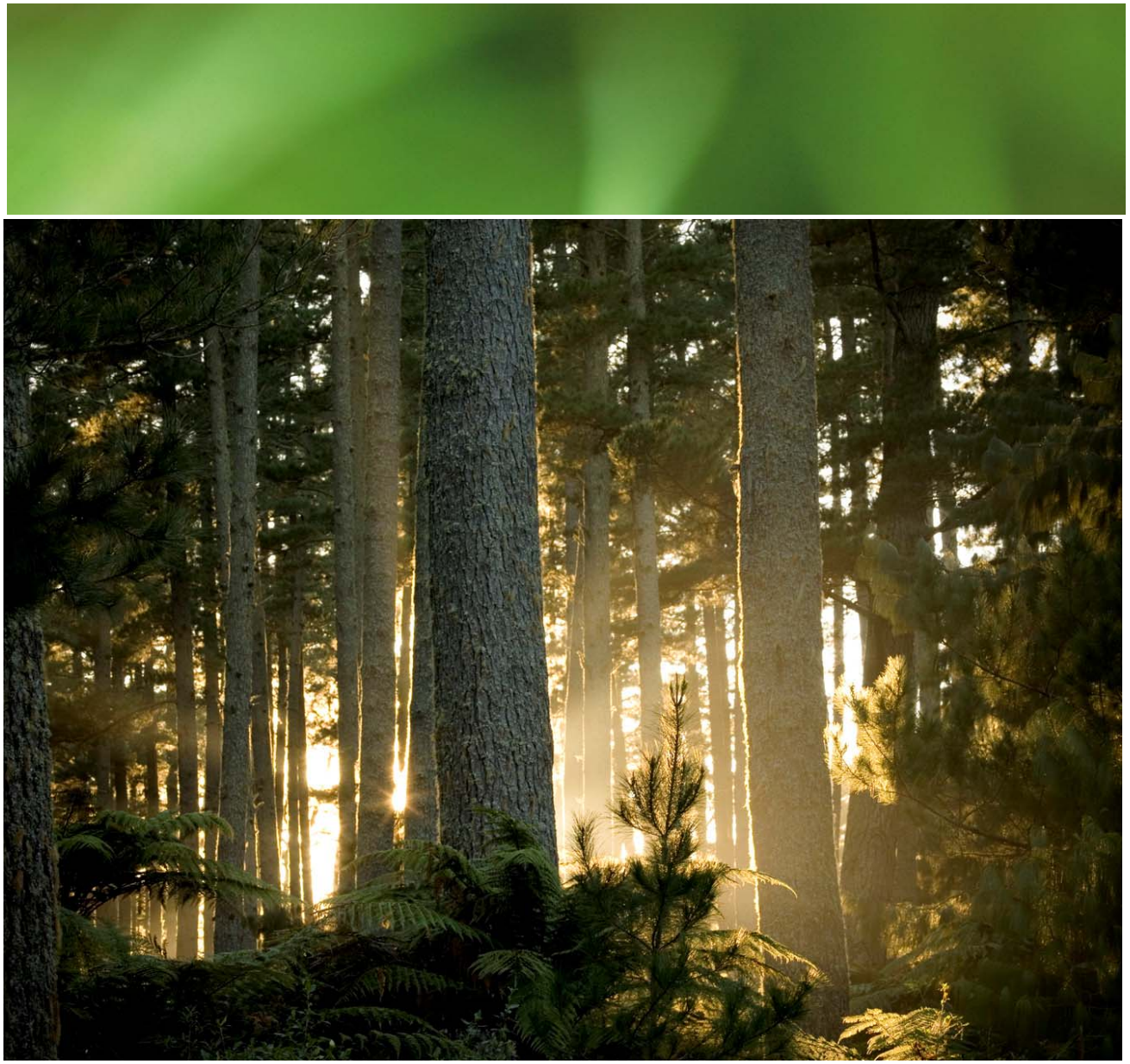

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SUMMARY

Untreated radiata pine framing timber was exposed to brown rot decay fungi and then treated with brush-on remedial preservatives. It was rewet and exposed in humid conditions over a three year period. Framing samples were assessed for decay and tested for deflection at regular intervals during the exposure period.

Treatment on three or four sides with a boron/glycol mixture gave effective protection against brown rot decay. Brush application on one or two edges was insufficient to stop further decay in pre-infected samples though there was very little change in deflection in samples treated on two edges.

Treatment with a copper naphthenate and kerosene mixture at the concentrations used slowed decay development but did not prevent it, regardless of the number of surfaces coated.

In samples treated with boron, some preservative was lost during wetting after treatment but the remaining preservative distributed through the sample cross section, including in samples where the moisture content was below 30%.

In copper naphthenate treated samples, preservative penetration was generally limited to a 5-10 mm envelope around the outside. Preservative retention and distribution did not change during the exposure period.

INTRODUCTION

Problems with the decay of untreated, kiln-dried radiata pine house framing when water penetrated the external covering (leaky buildings) became prominent in the late 1990's. While building regulations requiring the preservative treatment of radiata pine framing were re-introduced in 2003, a large number of deteriorating buildings constructed in the previous decade continued to require extensive repairs. This generally included re-cladding and replacement of unsound framing. Where framing appeared to be still sound, it was allowed to dry out and some type of brush-on remedial treatment was applied before new cladding was installed. The efficacy of these brush-on treatments in this type of situation had not been widely tested and there were many situations within buildings where the in-situ application of preservative could only reach one or two surfaces of the components. There was also some uncertainty about the identification of "incipient decay" and whether apparently sound timber adjacent to decaying timber could be successfully protected by brush-on remedial treatments. The possibility that minor decay in timber could be stopped by brush-on treatments was also questioned.

At that time there were two types of remedial treatment preservatives readily available to builders. These included a copper naphthenate concentrate that was diluted with a light

organic solvent such as kerosene or white spirits and the other was a boron/glycol solution. Zinc naphthenate concentrate was also available and being used for non-commercial applications but was regarded as a less effective fungicide than copper naphthenate.

This trial was established to determine:

- Whether copper naphthenate or boron brush-on treatments would be effective in controlling decay on framing that already contained incipient or lightly established decay
- The number of surfaces of a partially degraded component that needed to be coated to control decay
- The extent of decay that could be present in a component before it was significantly weakened

MATERIALS AND METHODS

Radiata pine sapwood framing, kiln dried and planer gauged to 90 mm x 45 mm, was cut into one metre long samples. A set of samples that had been commercially treated with boron to the H1.2 specification were also included. There were two exposure groups, high moisture content (HMC) samples, greater than 30% moisture content and low moisture content (LMC) samples, 25-30% moisture content. Samples were allocated randomly to the groups shown in Table 1.

TABLE 1 – SAMPLE TREATMENT AND EXPOSURE GROUPS

Group Code		Exposure Type	Number of samples /group	Pre-decay period (weeks)	Number of edges treated	Number of faces treated
Copper naphthenate treated	Boron treated					
C61H	B61H	HMC	20	8	1	-
C62H	B62H	HMC	20	8	2	-
C63H	B63H	HMC	20	8	2	1
C64H	B64H	HMC	20	8	2	2
C31H	B31H	HMC	20	4	1	-
C32H	B32H	HMC	20	4	2	-
C33H	B33H	HMC	20	4	2	1
C34H	B34H	HMC	20	4	2	2
C62L	B62L	LMC	10	12	2	-
C64L	B64L	LMC	10	12	2	2
C32L	B32L	LMC	10	7	2	-
C34L	B34L	LMC	10	7	2	2
	B3H	HMC	20	4	H1.2 treated	
	B3L	LMC	10	7	H1.2 treated	
U3H (untreated)		HMC	20	4	-	-
U3L (untreated)		LMC	10	7	-	-
UMH (untreated)		HMC	20	nil	-	-
UML (untreated)		LMC	10	nil	-	-

The samples were all weighed and their moisture content was determined by oven drying biscuits cut from between the samples. An oven-dry weight was calculated for each sample

using this moisture content data. All samples were end sealed with epoxy paint and later soaked in water until their moisture content was above 30%.

Small 35 mm square blocks of radiata pine sapwood that had been pre-infected with selected brown rot decay fungi, either *Oligoporus placenta* for samples to be exposed in wetter HMC conditions or *Gloeophyllum sepiarium* for samples that were to be exposed in drier LMC conditions, were attached near the centre of each sample on one edge. The samples were stacked in sealed plastic tanks with 20 mm thick plastic fillets separating the layers. In each tank there was a small amount of water in the bottom and a wet foam plastic blanket in the top to maintain high humidity. The tanks were kept in a laboratory where the ambient temperature was 15-20^{o} C. The intention was to pre-decay samples for two periods, the first just sufficient to produce "incipient decay" in the samples, the second to produce more established decay. Half of the HMC samples were left in the pre-decay tanks for four weeks, the remainder for eight weeks. The *G. sepiarium* decay blocks were slower to develop on the LMC samples and half of these samples were in the tanks for seven weeks, the remainder for twelve weeks. The commercially treated samples were kept in the tanks for four weeks, (HMC exposure samples) or seven weeks (LMC exposure samples).

At the end of the decay exposure period, samples were removed from the tanks, reweighed, assessed for mould, mycelium spread and decay using the rating systems in Appendix I. Decay feeder blocks were removed and external decay mycelium was cleaned off. Samples were then tested for deflection as a plank in a mechanical strength testing machine before being placed in filleted stacks in the laboratory. Large fans were used to blow air through the stacks until the sample moisture content was below 20%.

Remedial treatment products were applied, either 50/50 copper naphthenate and kerosene (1.2% Cu w/v) or a boric acid/borax mixture in monoethylene glycol (20% Boric Acid Equivalent). The surfaces coated were:

One surface	the edge that did not have a feeder block on it (HMC exposure only)
Two surfaces	both edges (HMC and LMC exposure)
Three surfaces	both edges and the numbered face (HMC exposure only)
All four sides	(HMC and LMC exposure)

Samples were weighed, coated, reweighed, allowed to dry for 30 minutes, reweighed, recoated and reweighed before being returned to filleted stack, where they were left overnight.

The samples were then re-soaked in water until the moisture content was above 30% for the HMC exposure samples or 25-30% moisture content for the LMC exposure samples. They were then re-weighed, tested for deflection and placed in filleted stacks, either in sealed tanks (HMC exposure samples) or in a controlled conditions room where the humidity was 95% and the temperature 25^{o}C (LMC exposure samples). Conditions in the HMC tanks were similar to those for the pre-treatment decay period except that the tanks were stored outside to provide similar temperatures that would be encountered in normal leaky building framing. Every 2-3 weeks during the exposure period the lids and foam plastic blanket were removed from the tanks and the samples were sprayed with water to ensure that the moisture content of the samples in the tanks remained above 30%. The LMC exposure stack was protected from direct wetting by humidity sprays with plastic covers. This ensured that most of the LMC samples stayed at a moisture content of 25-30%, (the equilibrium moisture content (EMC) for radiata pine at 25^{o}C and 95% humidity is about 26%). A few samples on the outside of the

stack and in the lower layers became slightly wetter due to condensation splashes on the floor and drips under the stack covers.

The trial was assessed for decay, mould and deflection at eight-week intervals from the start of the post-treatment exposure period in September 2009 to September 2010 and then at six-monthly intervals until September 2012. Full sample, preservative treatment, installation and progress details are in earlier reports. This report outlines installation of the trial, the condition of the samples at the end of the trial and major changes that occurred during the exposure period.

ASSESSMENT METHODS

For all assessments during the trial, samples were removed from the high moisture content exposure tanks (HMC) and low moisture content stack (LMC), weighed and measured. Visual assessments of decay mycelium development and mould infection were completed using the ratings systems shown in Appendix I. Moisture content calculations were based on changes in sample weight. The surfaces of each sample were tested with a blunt probe to determine whether the decay fungi were damaging the framing. Deflection as a plank under a constant load was measured. Modulus of Elasticity (MOE) for each sample was calculated using sample cross-section and deflection measurements.

After assessment the samples were returned to their original exposure positions. The HMC samples were sprayed with water as they were re-installed but the LMC samples were protected from wetting.

After the 159-week, final assessment, five samples for each preservative type, that had been treated on all four sides, were removed from each of the HMC and the LMC exposure groups. Biscuits were removed from each sample for chemical analysis and for reagent testing to determine the penetration of the preservative and the extent of decay. The analyses biscuits were taken 150 mm from each end of the sample, reagent testing biscuits were taken at the same points and from the centre of the sample adjacent to the original decay feeder block position.

RESULTS

Preservative uptake data indicated that the preservative retention in all of the copper naphthenate treated samples was well below the minimum of 0.10% (w/w Cu) required by the H3.1 specification in NZS 3640:2003 (Chemical Preservation of Round and Sawn Timber). Preservative retentions in samples treated with boron on three or four sides were generally above the minimum 0.4% BAE requirement of the H1.2 specification (Table 2).

Application rates of copper naphthenate on samples treated on one or two edges were lower than for other treatment groups. This was caused by most of the samples being flat-sawn hence the edges were less absorbent than the faces of the samples. As a result, less of the low viscosity, solvent based copper naphthenate preservative was retained on the edges during brush application, whereas the relatively sticky boron/glycol mixture stayed on the edges and was gradually absorbed during the period immediately after application.

TABLE 2
PRESERVATIVE APPLICATION RATES AND RETENTION

Treatment	Copper Naphthenate		Boron	
	Application Rate (g/m^2)	Retention (g/100g Cu)	Application Rate (g/m^2)	Retention (g/100g BAE)
HMC Samples				
One edge	149	0.006	182	0.107
Two edges	140	0.011	184	0.220
One face, two edges	188	0.028	182	0.426
Four sides	220	0.042	211	0.650
LMC Samples				
Two edges	168	0.013	179	0.215
Four sides	241	0.048	214	0.693

Decay mycelium was becoming established on the untreated surfaces of samples within six months of installation in the exposure stacks, generally spreading from the area originally infected by the decay feeder blocks. This progressed steadily, particularly on the untreated samples and those treated on only one edge. After 12 months mycelium spreading onto surfaces treated with copper naphthenate in the HMC tanks was recorded. Mycelium development on copper naphthenate treated surfaces in the HMC tanks continued throughout the trial although decay of the underlying wood was usually slow to develop (Figure 1).

Figure 1 – Decay on copper naphthenate treated samples after 159 weeks exposure, HMC tank 1, layer 5, (2nd from top). Extensive decay mycelium on the samples including on treated surfaces, still active and progressive.

By comparison there was no decay mycelium on boron treated surfaces and where decay mycelium developed on untreated surfaces in the boron exposure tanks it began to degenerate after two years exposure and was largely inactive by the end of the trial (Figure 2).

Figure 2 – Decay on boron treated samples, HMC tank 6, layer 6 (top layer). Extensive decay mycelium on the untreated sample (top) and two samples treated on the lower edge only, either side of sample B63H/8. No decay visible on the other treated samples and existing mycelium on untreated surfaces shows little sign of recent activity.

Moisture content and mould ratings at annual intervals are summarised in Table 3. Similar decay ratings and deflection data are summarised in Table 4.

The moisture content of the LMC samples remained relatively constant through the exposure period, generally close to 25% but slightly lower in the latter six months of the trial. Samples in the bottom three layers of the LMC stack were slightly wetter than average, mainly above 30% moisture content, due to splashing and condensation from the wet floor area.

Mould infection was relatively severe on untreated surfaces and ratings changes were relatively minor through the latter part of the exposure period.

The average moisture content of the HMC samples generally stayed above 30% throughout the exposure period although there was considerable variation between samples. Those in the upper two layers of each tank were wetter than average and boron treated samples tended to stay slightly wetter than the copper naphthenate treated samples.

TABLE 3
ANNUAL MOISTURE CONTENT AND MOULD RATINGS

Treatment Group Code	Moisture Content %			Mould Ratings		
	56 weeks	108 weeks	159 weeks	56 weeks	108 weeks	159 weeks
High Moisture Content Groups						
C61H	38	43[1]	43[1]	4.6	4.5	4.3
C62H	37	32[1]	33[1]	4.6	4.4	4.4
C63H	42	41	49	3.9	4.1	3.8
C64H	41	39	50	3.0	3.2	2.9
B61H	34	31[1]	44[1]	4.9	4.9	4.5
B62H	38	35	53	5.0	4.7	4.4
B63H	45	37	52	4.1	4.2	3.6
B64H	58	49	58	3.1	3.2	3.0
C31H	41	44[1]	43[1]	4.4	4.3	4.3
C32H	37	34[1]	31[1]	4.1	4.2	4.1
C33H	37	42	51[1]	3.5	3.6	3.8
C34H	39	37	44[1]	2.8	2.9	2.9
B31H	34	29[1]	43[1]	4.8	4.8	4.4
B32H	36	36	52	4.8	4.6	4.4
B33H	43	38	49	3.8	4.2	3.6
B34H	50	42	57	3.0	3.3	2.8
B3H	53	52	81	2.4	2.3	2.6
U3H	33	31[1]	31[1]	4.2	4.4	4.4
UMH	36	37	50	4.4	4.6	4.6
Low Moisture Content Groups (157 weeks)						
C62L	23	21	21[1]	4.1	4.6	4.4
C64L	25	23	19[1]	3.5	4.3	4.1
B62L	24	25	24	3.8	4.4	4.0
B64L	29	31	30	2.3	2.3	2.2
C32L	26	22	19[1]	4.1	4.7	4.4
C34L	27	25	23	3.6	4.0	3.7
B32L	27	27	27	3.9	4.1	3.9
B34L	28	32	28	2.2	2.2	2.3
B3L	30	34	34	2.2	2.2	2.1
U3L	25	22	19[1]	4.1	4.6	4.3
UML	27	25	24[1]	4.0	4.3	4.3

[1] Extensive decay in some samples from this group reduced their weight, therefore moisture content calculations based on weight are likely to be inaccurate.

TABLE 4
ANNUAL MYCELIUM SPREAD, INDEX OF CONDITION AND DEFLECTION

Group Code	Mycelium Spread Rating			Index of Condition[1]			Deflection (mm)		
	56-wk	108-wk	159-wk	56-wk	108-wk	159-wk	56-wk	108-wk	159-wk
High Moisture Content Groups (159 weeks)									
C61H	3.4	4.2	5.3	7.6	6.5(1)[3]	4.5(3)	2.36	3.04	3.92
C62H	3.6	4.2	5.4	7.8	6.5(1)	4.3(3)	2.46	2.94	4.26
C63H	3.1	3.2	4.3	8.0	7.6	6.1(2)	2.16	2.31	3.07
C64H	1.1	1.9	2.4	8.0	7.8	7.6	2.16	2.22	2.30
B61H	3.6	4.1	4.7	7.3	6.5	5.6	2.31	2.92	3.25
B62H	1.5	1.5	1.7	8.0	8.0	8.3	2.38	2.40	2.44
B63H	1.2	1.1	1.1	8.3	8.2	8.6	2.13	2.16	2.20
B64H	1.0	1.0	1.0	8.2	8.1	8.5	2.19	2.24	2.25
C31H	3.3	4.3	5.1	7.6	6.9	4.7(4)	2.46	2.93	4.31
C32H	3.2	4.2	5.5	7.9(1)	6.3(1)	3.5(8)	2.50	3.06	5.20
C33H	2.1	3.2	4.6	8.7	7.8	6.5	2.47	2.64	3.11
C34H	1.3	2.7	3.8	8.8	8.3	6.7(2)	2.29	2.46	3.15
B31H	4.1	4.5	5.0	6.9	6.0	4.6(2)	2.69	3.62	4.26
B32H	1.7	1.6	1.8	9.0	8.5	8.9	2.30	2.32	2.37
B33H	1.0	1.0	1.0	9.5	9.2	9.8	2.33	2.32	2.36
B34H	1.0	1.0	1.3	9.3	8.9	9.4	2.18	2.19	2.24
B3H[2]	1.0	1.0	1.0	10.0	10.0	10.0	3.88	3.88	3.93
U3H	3.9	4.5	5.2	7.2	5.1(4)	2.9(10)	2.66	4.11	5.76
UMH	2.7	2.4	2.9	9.4	8.5	7.7(2)	2.28	2.39	3.01
Low Moisture Content Groups (157 weeks)									
C62L	3.1	3.8	3.4	6.4(1)	5.4(2)	4.7(3)	3.19	3.75	4.21
C64L	1.3	1.6	1.8	7.9	7.3	7.7	2.35	2.52	2.58
B62L	2.4	2.8	3.2	7.7	7.5	7.3	2.55	2.61	2.71
B64L	1.0	1.0	1.0	8.0	8.0	8.2	2.29	2.39	2.36
C32L	2.2	2.9	3.3	8.1	7.3	6.1(1)	2.22	3.15	3.29
C34L	1.0	1.1	1.0	8.2	8.0	8.1	2.08	2.21	2.18
B32L	1.1	1.6	1.7	8.3	8.1	8.3	2.09	2.18	2.18
B34L	1.0	1.0	1.0	8.2	8.4	8.4	2.30	2.39	2.36
B3L[2]	1.1	1.0	1.0	10.0	10.0	10.0	3.73	3.84	3.83
U3L	2.5	3.4	3.9	6.3(1)	5.0(3)	4.4(3)	3.37	4.21	4.18
UML	1.7	1.9	2.2	9.6	8.1(1)	7.5(1)	2.25	2.99	3.02

[1] Index of Condition is the average decay rating for all of the samples in a group.
[2] This group was framing grade timber, all other groups were clears grade sapwood.
[3] The number of samples in the group that had failed (in parenthesis).

If the type of preservative used and exposure conditions are ignored, there were only minor changes in average decay ratings and MOE for samples treated on four surfaces, throughout the trial period (Figures 3 and 4). For samples treated on two edges and one face average ratings were similar to the samples treated on four sides until the last assessment when decay ratings declined more rapidly. From the outset, MOE for these samples was generally lower than for samples treated on four sides but changes over the first 137 weeks mirrored those for the samples treated on all four sides. Over the last six months exposure MOE declined more rapidly in the samples treated on three sides.

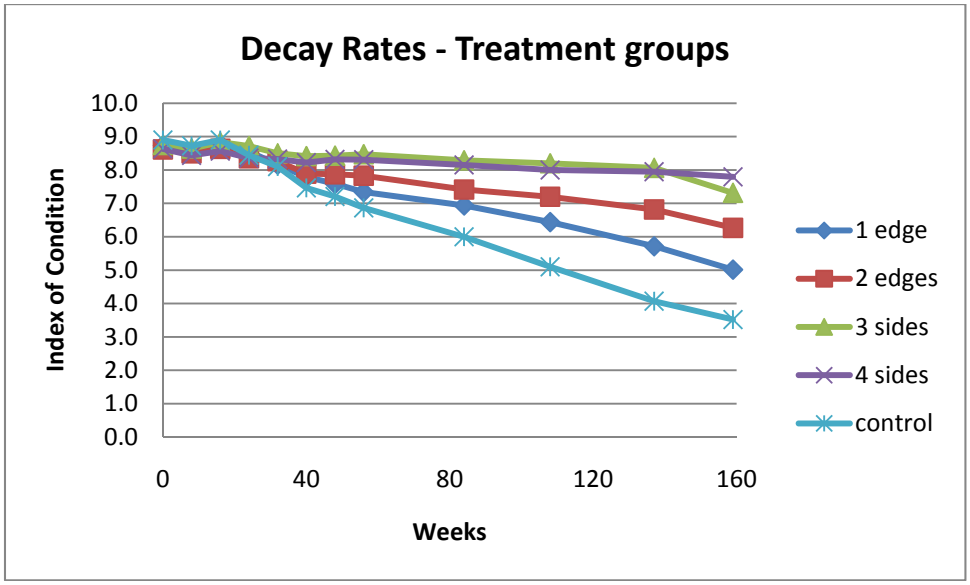

Figure 3 - Changes in the "Index of Condition", regardless of the preservative used or the exposure conditions, as the trial progressed.

There was a steady decline in decay ratings for samples treated on one edge or on two edges from the 16-week assessment until the end of the trial. By the 159-week assessment the samples treated on one edge had an Index of Condition below 5.0. This point had been reached by untreated control samples after 108 weeks. The decline in average MOE for the "one edge" and "two edge" treated groups did not begin to show up until the 40-week assessment. Since then it has continued steadily with the "one edge" treatment groups losing strength more rapidly than the "two edge" treatment groups.

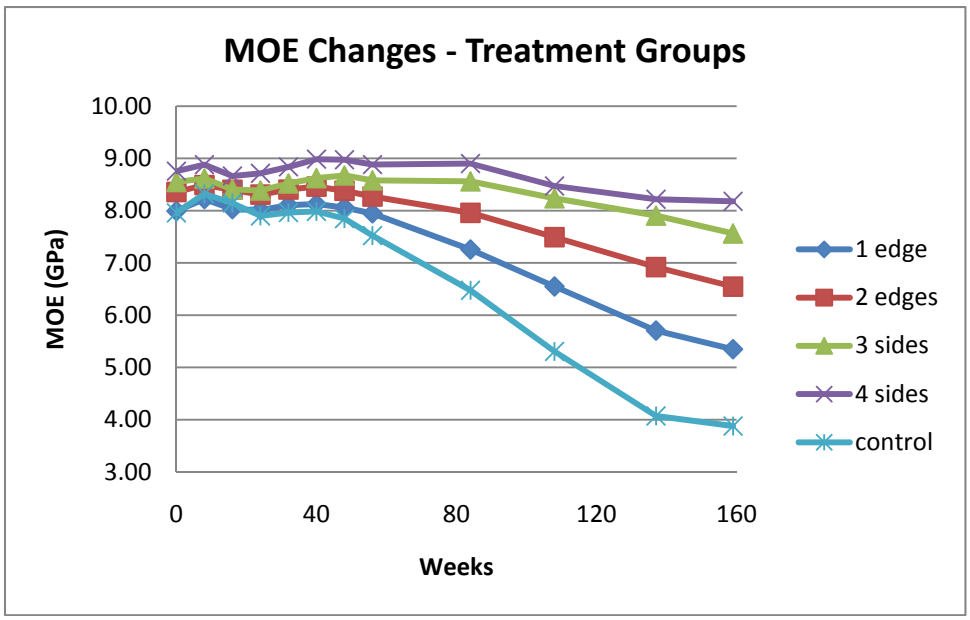

Figure 4 - The modulus of elasticity (MOE) regardless of the preservative used or the exposure conditions, as the trial progressed.

When the MOE figures for the treatment groups are separated by preservatives, the copper naphthenate samples treated on one or two edges show steady and similar stiffness loss (Figure 5). The average MOE of the “three sides” copper naphthenate treated groups was always lower than the MOE of the “four sides” treated group but declined at a similar rate until the 137-week assessment. Between the 137-week and the 159-week assessments the MOE of the “three sides” treatment groups declined more rapidly.

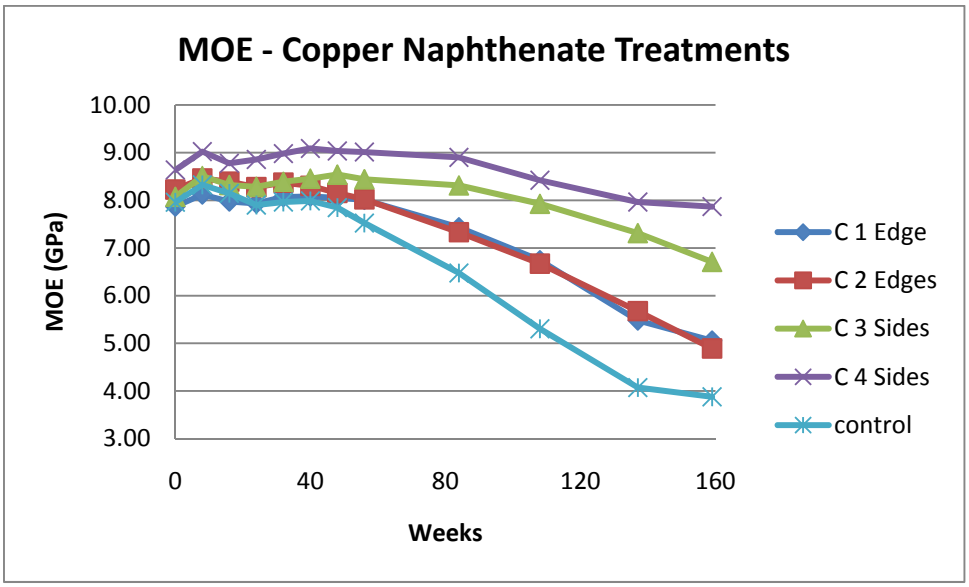

Figure 5 - The modulus of elasticity (MOE) for copper naphthenate treated samples, combined HMC and LMC data.

The boron treated groups were quite different (Figure 6). The MOE for all except the “one edge” treatment groups changed very little throughout the trial. The MOE for the “one edge” treatment groups declined steadily from the 40-week assessment until the end of the trial.

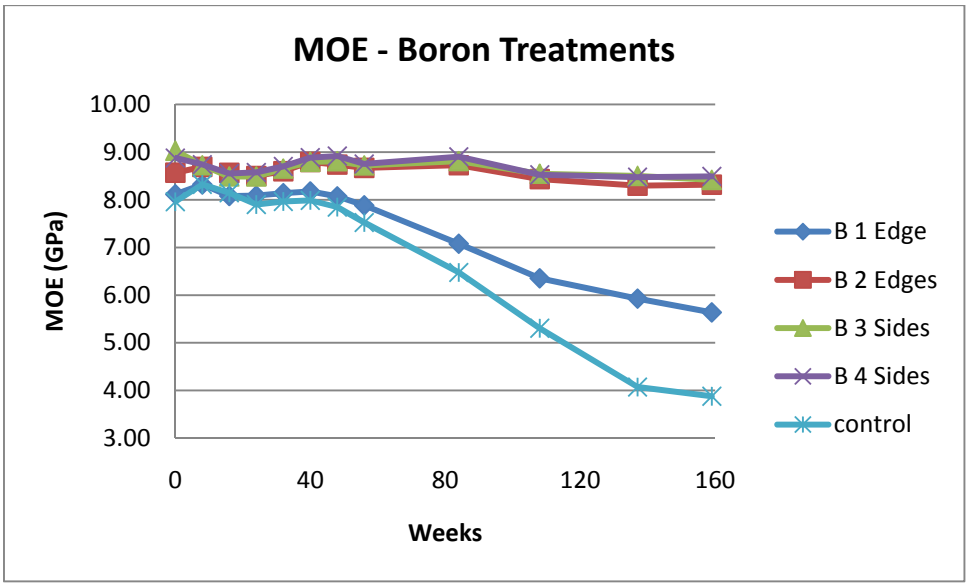

Figure 6 - The modulus of elasticity (MOE) for boron treated samples, combined HMC and LMC data.

Figures 7 and 8 compare the MOE of LMC exposure stack treatment groups with the equivalent groups from the HMC exposure tanks. These show that the samples treated on two edges with copper naphthenate rapidly lost stiffness whereas the boron treated samples and those treated with copper naphthenate on four sides only changed very slowly.

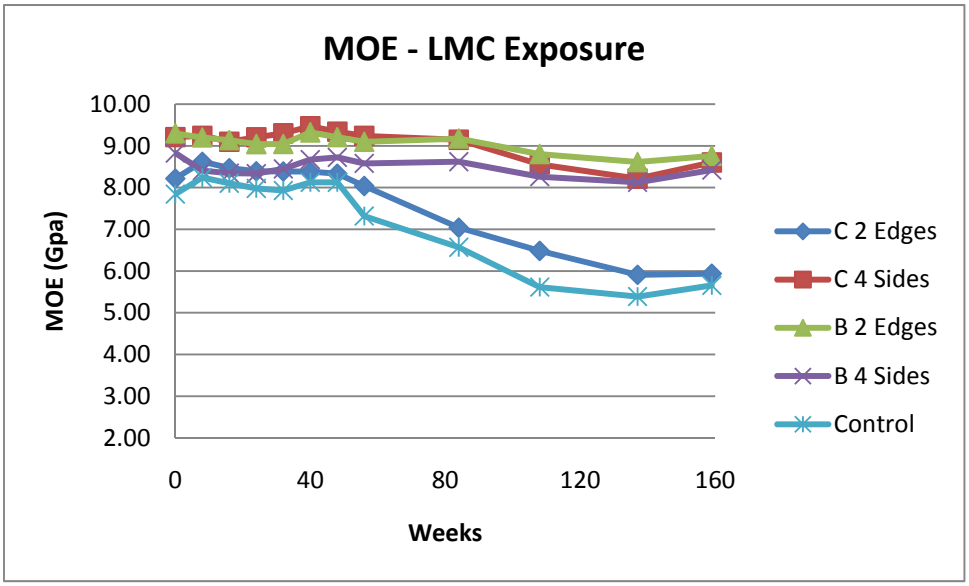

Figure 7 - The modulus of elasticity (MOE) in the low moisture content stack.

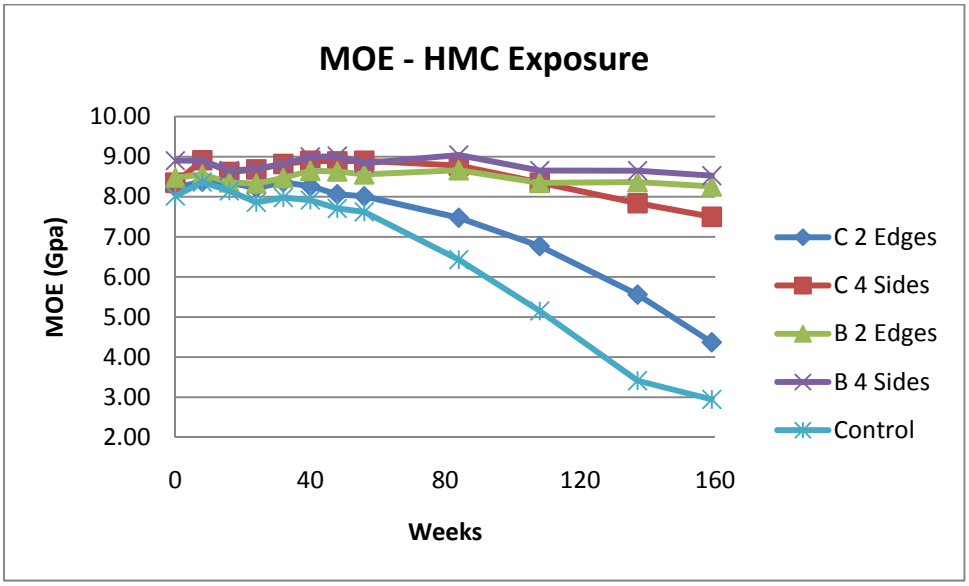

Figure 8 - The modulus of elasticity (MOE) in the high moisture content tanks, samples treated on two edges or four sides only.

In the HMC tanks the samples treated with copper naphthenate on four sides began to lose strength more rapidly than boron treated samples over the final year's exposure. In the LMC stack the loss of MOE in the untreated controls and the group treated with copper naphthenate on two edges slowed over the final year's exposure. This was associated with

severe decay developing in only those samples with higher moisture content, most of which failed in the first two years exposure.

TABLE 5
SAMPLES WITH MODERATE-SEVERE, SEVERE DECAY OR FAILED

	Copper Naphthenate			Boron		
Treatment	56-wk	108-wk	159-wk	56-wk	108-wk	159-wk
High Moisture Content Exposure (40 samples/group)						
One edge	5	12	32	7	23	36
Two edges	2	13	35	1	1	1
One face two edges	0	0	19	0	0	0
Four sides	0	3	9	0	0	0
Control (20 samples)				5	13	17
Low Moisture Content exposure (20 samples/group)						
Two edges	3	4	6	1	1	2
Four sides	0	0	0	0	0	0
Control (10 samples)				2	4	6

Noticeable deflection increases and changes in MOE have generally been restricted to those samples which contained moderate-severe decay (ratings 6 or lower). The number of samples with moderate-severe decay, severe decay and those that have failed are in Table 5. This indicates that the percentage of samples with moderate-severe decay or worse is similar to the control groups for copper naphthenate treated on one or two edges groups and the boron treated on one edge group. There was a rapid increase in the number of samples with severe decay in the copper naphthenate treated on three sides group between the 108-week and 159-week assessments. This mirrors the more rapid loss of MOE in that group in Figure 5.

The analytical results in Table 6 show that there was no significant loss of copper naphthenate over the exposure period whereas preservative retention in the HMC boron treated samples has been reduced by between 24% and 55%. The sample in the upper layer of the exposure tank (B64H/4) had the highest loss and samples lower in the tank lost progressively less. This is partly explained by the samples in the top layer remaining very wet through the whole of the trial period due to condensation drips from the lid and the foam plastic blanket on top of the stack. There may also have been some preservative wash-off when the samples were sprayed after assessment and during exposure. This is likely to have contributed to the gradual degradation of mycelium on the surface of samples in the boron exposure tanks. Samples in the LMC stack were not sprayed with water and condensation drippage affected only a few in specific areas of the stack. Boron loss in the analysed samples varied from 27% to 47%. The only time that all of the LMC samples were wet was at the start of the exposure period when the dry, treated samples were soaked in water to raise the moisture content above 25%. This suggests that most of the boron loss in both LMC and HMC samples occurred during pre-exposure wetting rather than during the exposure period. Even with this boron loss the retention in the samples remained close to or above 0.4% BAE.

TABLE 6
PRESERVATIVE RETENTION AND DECAY IN ANALYSED SAMPLES AFTER 159 WEEKS EXPOSURE

Sample Number	Preservative Retention (% wt/wt)		Layer[2]	Condition[3]
	Initial[1]	Final		
Copper Naphthenate Samples, HMC (%Cu)				
C34H/6	0.04	0.04	4	5/8
C64H/5	0.05	0.04	6	1/8
C64H/11	0.08	0.08	5	1/8
C64H/12	0.04	0.04	2	3/8
C64H/15	0.05	0.05	3	4/8
Copper Naphthenate Samples, LMC (%Cu)				
C34L/2	0.03	0.02	5	1/8
C64L/1	0.06	0.06	1	3/8
C64L/3	0.04	0.04	10	3/8
C64L/8	0.06	0.06	2	1/7
C64L/9	0.04	0.05	8	1/8
Boron Samples, HMC (%BAE)[4]				
B34H/11	0.54	0.32	4	1/9
B34H/12	0.59	0.40	3	1/9
B64H/3	0.79	0.44	5	1/9
B64H/4	0.66	0.30	6	1/9
B64H/8	0.84	0.64	2	1/8
Boron Samples, LMC (%BAE)				
B34L/3	0.85	0.55	2	1/10
B34L/10	0.64	0.34	3	1/8
B64L/2	0.72	0.44	5	1/8
B64L/6	0.60	0.36	10	1/8
B64L/9	0.63	0.46	8	1/8

[1] The initial retention was calculated using the weight of preservative applied and the oven dry weight of the sample.

[2] There were six layers in the HMC tanks and ten layers in the LMC stack. Layer 1 was the bottom layer.

[3] Condition is the rating for mycelium spread/decay rating for each sample. A mycelium rating of "1" indicates that any decay present was caused by decay feeder blocks, before the samples were treated.

[4] Boric Acid Equivalent.

Table 7 compares decay ratings and MOE loss from the start of the exposure period in samples that were spot tested in Figures 9-18. These show that there were well established pockets of decay present in the centre of the samples before significant MOE loss occurred. In samples where decay developed at either or both ends but not in the centre, such as in the second to bottom sample in Figure 9, there was very little loss of MOE.

In Figures 9-18 the distribution of copper in the copper naphthenate treated samples is relatively close to the surface and shows very little evidence of redistribution following treatment. The boron treated samples all show that the preservative has spread through the whole sample cross-section, even in samples that were below 30% moisture content. Given the limited copper penetration in the copper naphthenate treated samples it is likely that

copper retention in the penetrated section would have been much closer to the H3.1 specification requirement of 0.10% Cu than the cross-sectional retention shown in Table 2. Considering that mycelium spread onto copper naphthenate treated surfaces during the latter part of the exposure period in the HMC tanks and a number of samples that were treated on four sides either failed or contained severe decay (Table 5), it is unlikely that a cross-sectional retention of 0.10% Cu would have given complete protection against brown rot decay.

TABLE 7
DECAY RATINGS AND MOE CHANGE AFTER 159 WEEKS EXPOSURE

Sample Number	Decay Rating	MOEp (GPa)	MOE % loss	Sample Number	Decay Rating	MOEp (GPa)	MOE % loss
HMC exposure							
Copper naphthenate treated 4 sides				**Boron treated 4 sides**			
C34H/6	8	6.9	9	B34H/11	9	10.2	1
C64H/5	8	7.2	2	B34H/12	9	8.4	-1
C64H/11	8	6.4	-1	B64H/3	8	7.4	3
C64H/12	8	8.7	0	B64H/4	9	9.6	6
C64H/15	8	6.8	6	B64H/8	8	7.4	-3
Copper naphthenate treated 3 sides				**Boron treated 3 sides**			
C33H/11	9	7.3	3	B33H/9	10	10.1	2
C33H/12	7	7.4	6	B63H/15	8	7.3	1
C63H/1	7	9.5	9	B63H/16	9	7.6	-2
C63H/3	7	7.3	11	B63H/17	8	7.8	5
C63H/9	6	8.5	16	B63H/19	9	9.9	6
Copper naphthenate treated 2 edges				**Boron treated 2 edges**			
C32H/7	6	4.2	41	B32H/3	10	9.9	6
C32H/11	7	9.0	3	B32H/14	7	8.9	3
C62H/3	4	6.2	41	B62H/5	7	6.4	1
C62H/11	7	7.1	15	B62H/6	8	8.5	5
C62H/19	6	8.0	20	B62H/17	8	9.4	2
LMC exposure (157 weeks)							
Copper naphthenate treated 4 sides				**Boron treated 4 sides**			
C34L/2	8	11.0	-9	B34L/3	10	7.9	3
C64L/1	8	5.8	22	B34L/10	8	9.0	6
C64L/3	8	9.7	-4	B64L/2	8	7.8	1
C64L/8	7	6.0	12	B64L/6	8	9.8	7
C64L/9	8	10.3	-4	B64L/9	8	10.9	-3
Copper naphthenate treated 2 edges				**Boron treated 2 edges**			
C32L/8	4	7.9	25	B32L/2	7	10.1	8
C62L/2	7	7.3	-9	B32L/10	7	10.6	3
C62L/8	6	9.1	9	B62L/2	8	11.3	4
C62L/9	8	7.8	-11	B62L/5	8	10.8	3
C62L/10	8	6.9	-12	B62L7	8	6.7	-6

MOE increased in a number of samples over the exposure period, particularly in the LMC stack. This was associated with the gradual moisture content reduction in samples where

there was no decay development beyond the pre-treatment infection. The moisture content of LMC samples was generally between 25% and 30%. This is close to or fractionally below the fibre saturation point of radiata pine. Deflection is unlikely to be influenced by moisture content when the wood is above fibre saturation point but will be reduced as moisture content decreases below that. Hence MOE would have increased slightly as the moisture content of the drier, relatively sound LMC samples declined.

Samples treated with boron on two or more sides had less decay and showed fewer MOE changes than the equivalent copper naphthenate treated samples. Even where there was major decay through the length of the sample, e.g., the top sample in Figure 14, there was no serious loss of MOE. Decay in these samples was generally restricted to a strip through the centre away from the boron treated edges and the wood either side of this remained intact. The samples were tested for deflection as a plank, hence the decay would have had little effect on deflection.

CONCLUSIONS

Boron glycol mixture applied to three or four sides of 50 mm thick radiata pine framing at a rate that achieves 0.4% BAE retention will protect against decay development.

Wetting of brush-on boron treated timber will remove some of the boron but the remaining preservative is likely to redistribute through the sapwood cross section when the moisture content is above 25%.

Copper naphthenate in kerosene at the applied retention slowed brown rot decay development but did not prevent it. The application of higher strength preservative solution may have reduced decay spread on the surface but limited penetration is unlikely to prevent internal decay development.

After effective remedial treatment, framing with small amounts of decay on it is unlikely to fail in normal building situations. Small amounts of decay, if not remedially treated, are likely to continue to develop if timber is rewet.

Figure 9 – Decay and preservative penetration in copper naphthenate treated samples (HMC samples treated on four sides in Table 6). The samples on the left have been sprayed with methyl orange reagent which turns a pink-red colour where there is active decay. The samples on the right are matched with the decay test samples and have been sprayed with rubeanic acid reagent which turns blue-black in the presence of copper. The three biscuits in each set are from the same sample, the central "C" sample from the original decay feeder block position, the "A" and "B" samples 150 mm from each end. There is limited, variable copper penetration and active decay in three of the samples.

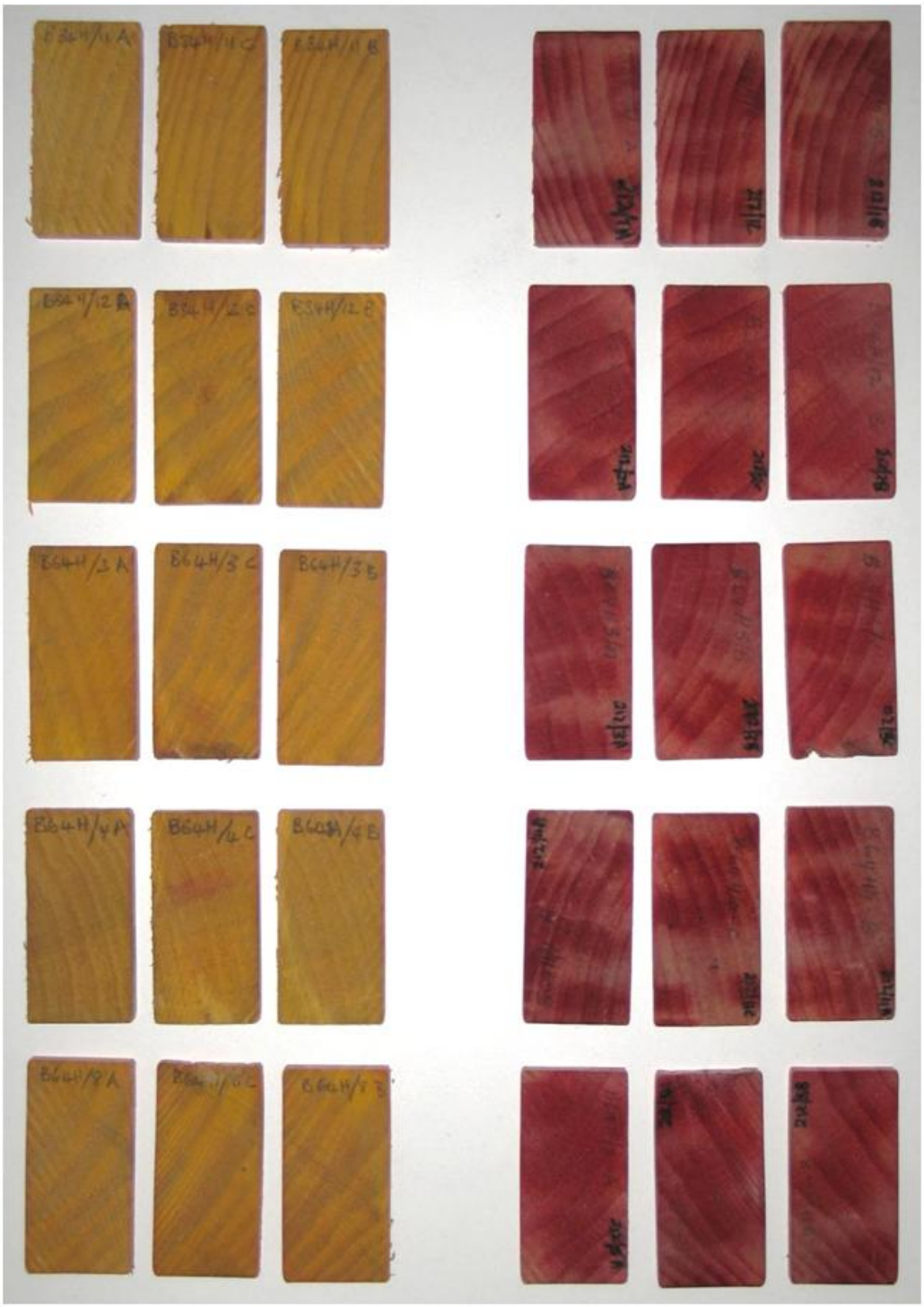

Figure 10 – Decay and preservative penetration in boron treated samples (HMC samples treated on four sides in Table 6). The samples on the left have been sprayed with methyl orange reagent which turns a pink-red colour where there is active decay. The samples on the right are matched with the decay test samples and have been sprayed with a tumeric reagent which turns red in the presence of boron. The three biscuits in each set are from the same sample, the central "C" sample from the original decay feeder block position, the "A" and "B" samples 150 mm from each end. The boron appears to have diffused through the sample and there is no active decay.

Figure 11 – Decay and preservative penetration in copper naphthenate treated samples (HMC tanks treated on one face and two edges). Preservative penetration is limited and all samples contain some decay extending into the treated areas.

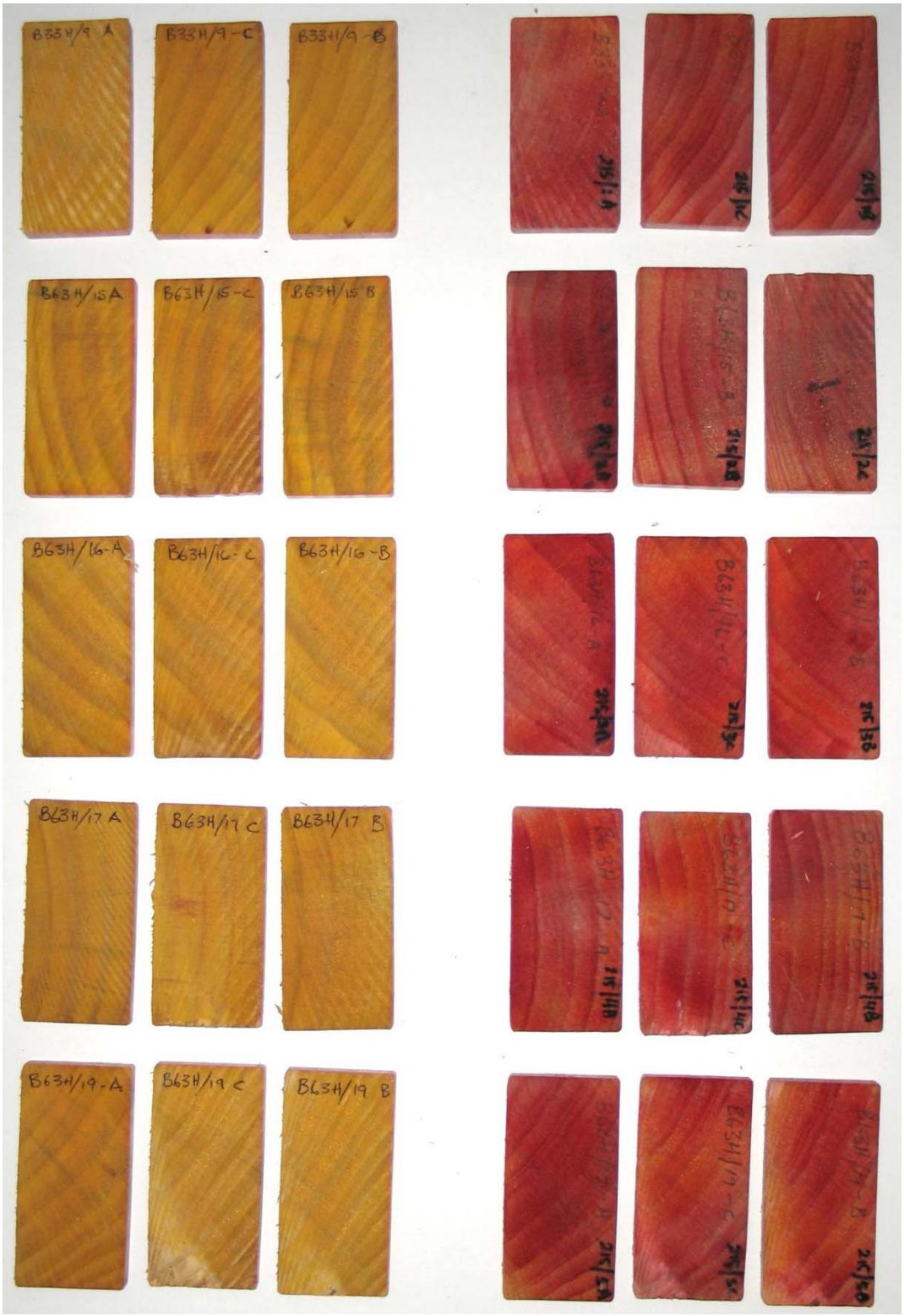

Figure 12 – Decay and preservative penetration in boron treated samples (HMC tanks treated on one face and two edges). Boron appears to have diffused right through the samples and there appears to be no decay except minor areas of inactive brown rot on the edges of the central biscuit where the decay feeder block was originally attached.

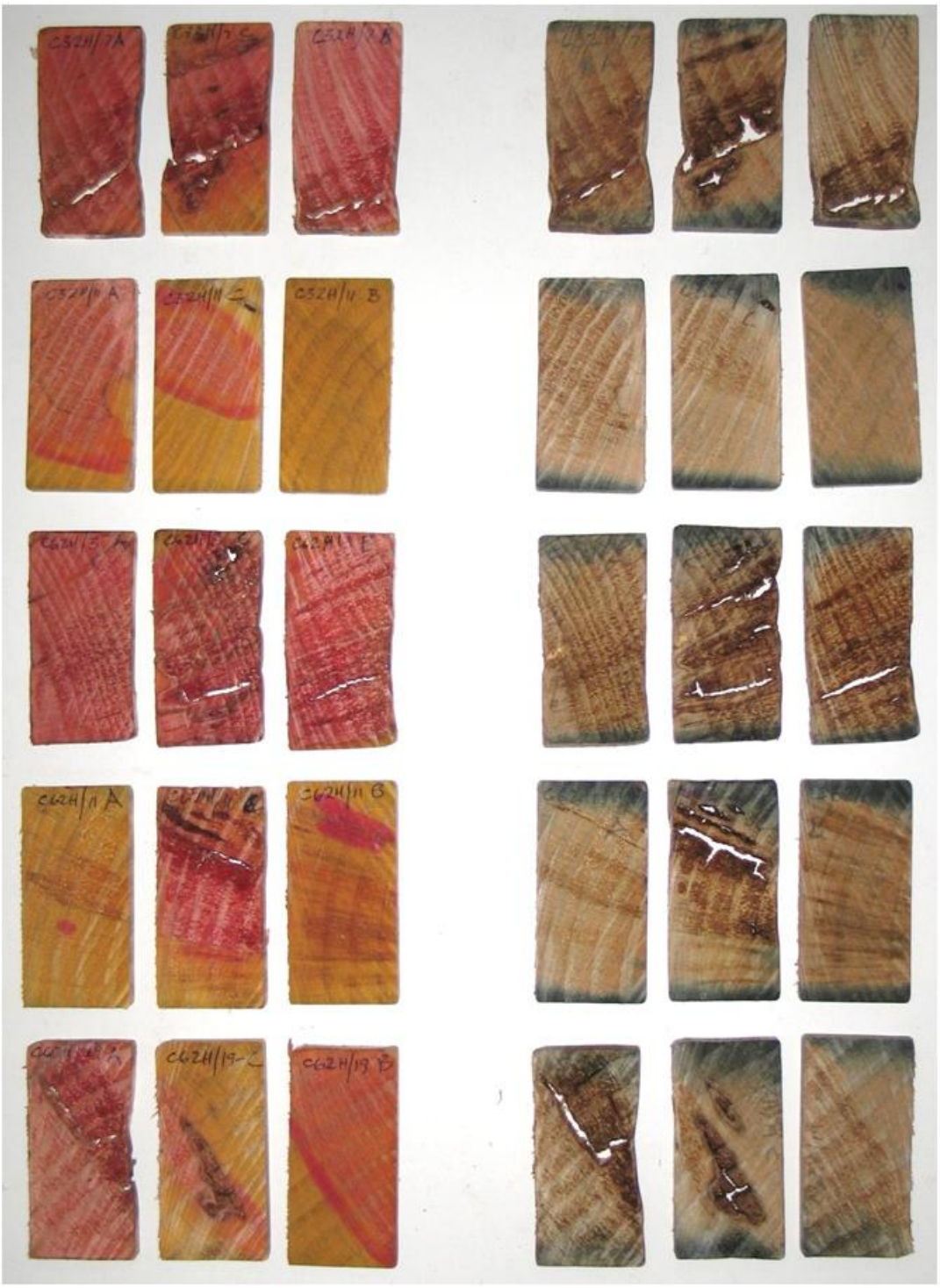

Figure 13 – Decay and preservative penetration in copper naphthenate treated samples (HMC tank treated on two edges). All samples contain extensive decay although in the second from top sample it was mainly at one end. There was limited preservative penetration and decay was active up to and through the treated area.

Figure 14 – Decay and preservative penetration in boron treated samples (HMC tank treated on two edges). All samples contain some decay although in the three lower samples it appeared to be from the original feeder block and was inactive. The reagent test colour suggests that the boron had spread through the sample from the two edges that it had originally been applied to.

Figure 15 – Decay and preservative penetration in copper naphthenate treated samples (LMC samples treated on four sides in Table 4). There is limited copper penetration and there was active decay through the centre of the top four samples. Decay in the bottom sample was limited to the central section on one edge and had spread slightly from the area where the original decay feeder block had been attached.

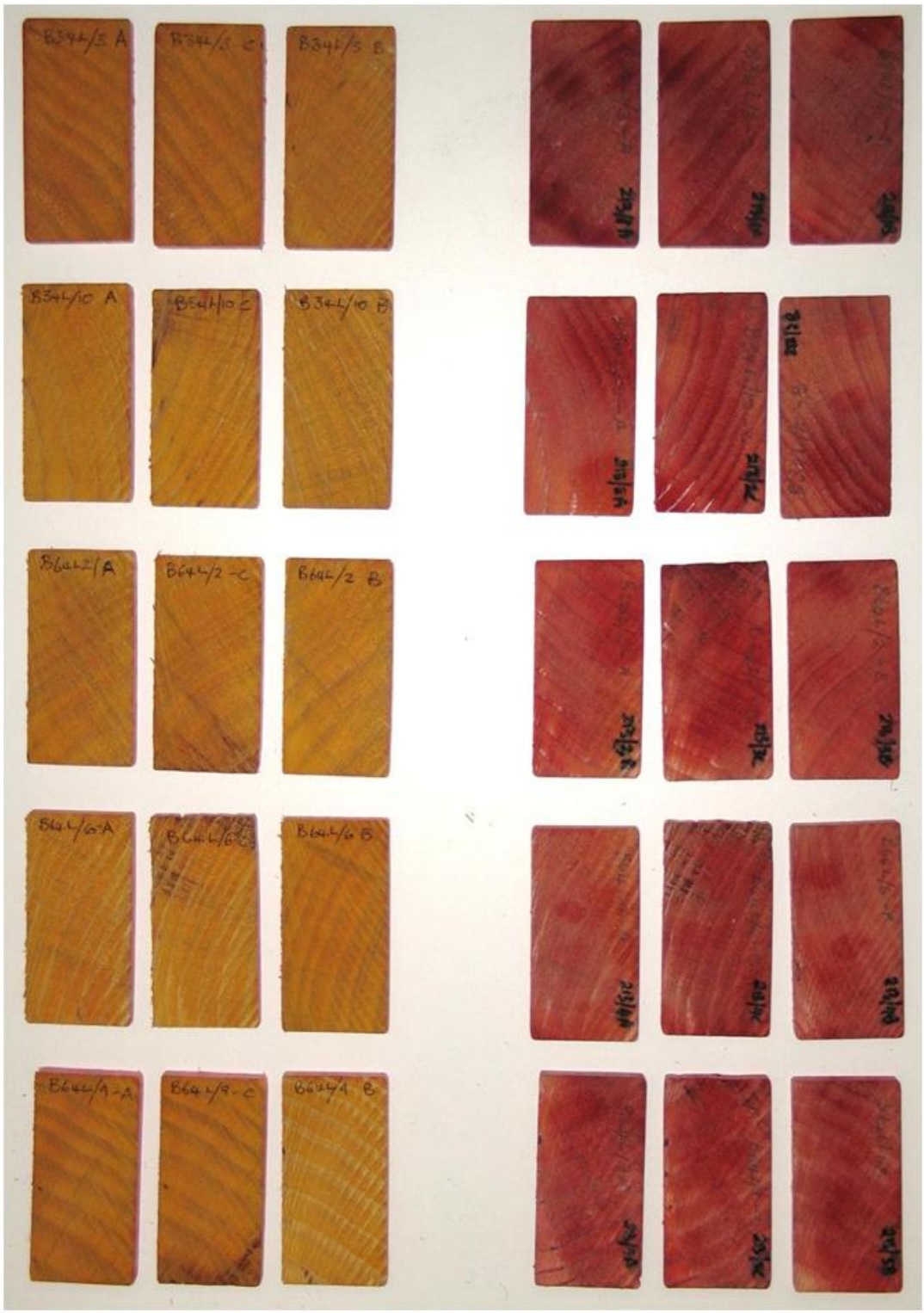

Figure 16 – Decay and preservative penetration in boron treated samples (LMC samples treated on four sides in Table 4). The boron appears to have diffused through the samples and the only decay is inactive, on the edge of the central biscuits where the original decay feeder block was attached.

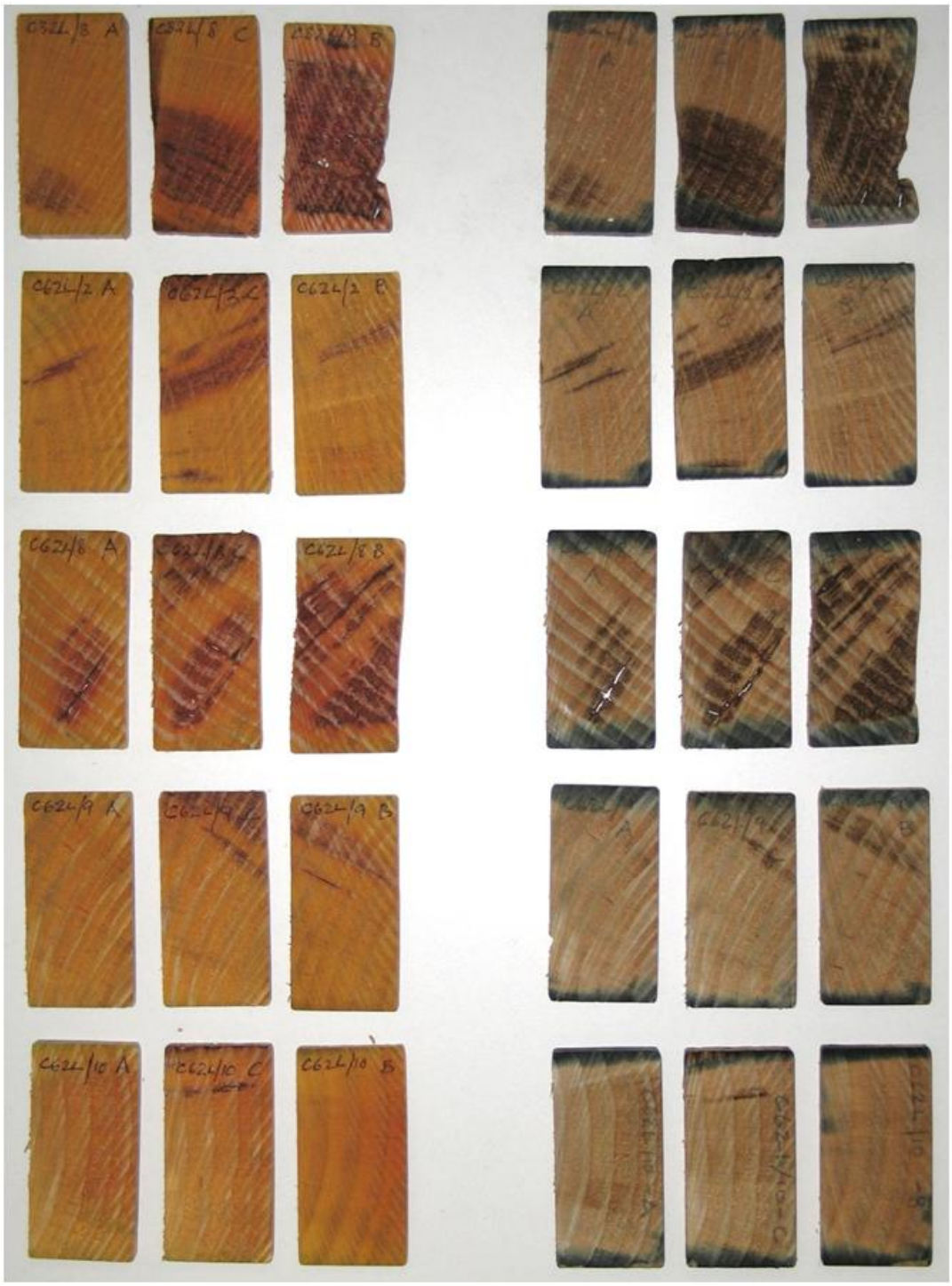

Figure 17 – Decay and preservative penetration in copper naphthenate treated samples (LMC stack treated on two edges). All samples contain some decay although the decay in the bottom two samples was from the original feeder block and appeared inactive. There was limited preservative penetration and decay was active up to the treated area.

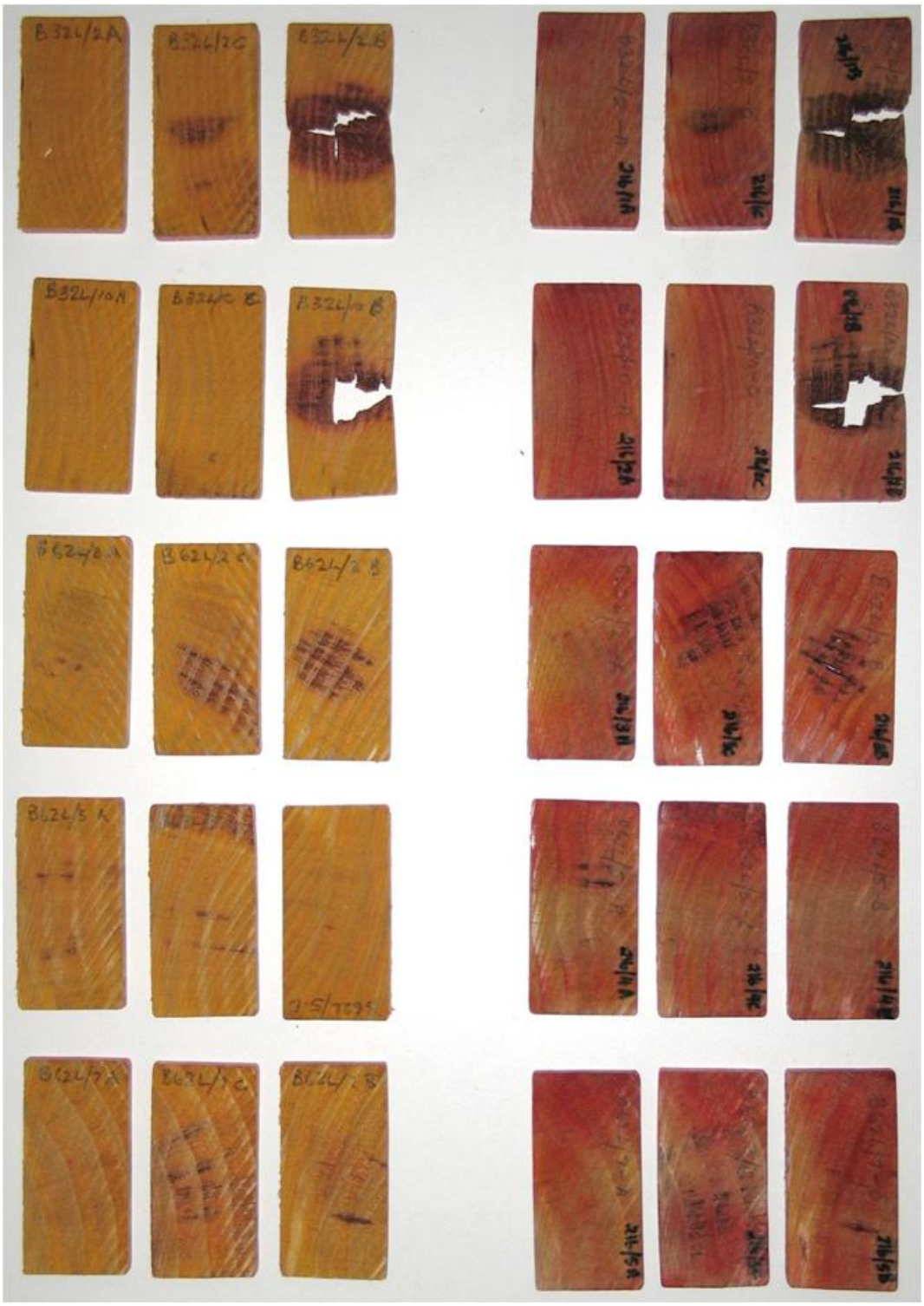

Figure 18 – Decay and preservative penetration in boron treated samples (LMC stack treated on two edges). All samples contain some decay although the decay in the upper edge of the central biscuit of the second to bottom sample was from the original feeder block and appeared inactive. The reagent test colour suggests that there was very little boron present although it had spread through the sample from the two edges that it had originally been applied to.

Figure 19 – LMC sample C64L/5 treated with copper naphthenate on four sides after 157 weeks exposure. This was in layer 5 near one side of the stack and would have not been wet by condensation drips hence its moisture content would have been between 25% and 30% for the duration of the trial. There were decay fruiting bodies at one end and decay extending full length of the sample through the centre. There was no decay on the exterior of the sample except what appeared to be an inactive area at the point where the original decay feeder block had been attached before treatment.

Figure 20 – HMC sample C34H/12 treated with copper naphthenate on four sides after 159 weeks exposure. Decay, probably originating from the pre-treatment decay feeder block has broken through the preservative treated envelope and is beginning to spread along the sample surface.

Figure 21 – HMC sample C32H/10 treated with copper naphthenate on two edges after 159 weeks exposure. Decay has spread along the length of the sample including over the treated edges. It was severe in patches and the sample rating was 6 (30-50% of the cross section decayed). MOE had declined by 11% during the exposure period.

Figure 22 – HMC sample C34H/7 treated with copper naphthenate on four sides after 159 weeks exposure. Decay had spread along the length of the sample and it failed during deflection testing at the 159-week assessment.

Figure 23 – HMC sample B61H/12 treated with boron on one edge after 159 weeks exposure. There was severe decay throughout the sample, away from the treated edge. This was typical of many of the samples in the group that were treated with boron on one edge only.

Figure 24 – HMC sample B32H/13 treated with boron on two edges after 159 weeks exposure. There was a strip of severe decay through the centre of the sample but this had not spread to the treated edges. This sample was in the top layer of the tank and it is likely that boron loss would have been greater than for samples lower in the tank. MOE for this sample had reduced by 23% over the exposure period due to this decay (rated 6, 30-50% of the cross section).

APPENDIX I
RATINGS SYTEMS USED FOR SAMPLE ASSESSMENTS

Mycelium Spread Ratings

1 = No mycelium development onto the sample surface.
2 = Mycelium on the surface in the immediate vicinity of the feeder block.
3 = Active mycelium from the feeder block on the surface, spread <50 mm.
4 = Active mycelium development >50 mm from the feeder block.
5 = Extensive mycelium development over <50% of the surface area.
6 = Extensive mycelium development over >50% of the surface area.

Mould Ratings

1 = No perceivable mould.
2 = Light mould patches or a few widely scattered spots.
3 = Numerous spots or widespread light mould.
4 = Severe mould, up to 50% coverage.
5 = Severe mould, >50% coverage.

Decay Ratings

10 = No decay.
T = Trace, discolouration or softening, not positively identified as decay.
9 = First stages of decay or damage up to 3% of cross-section.
8 = Lightly established decay, 3-10% of cross-section.
7 = Well established decay, 10-30% of cross section.
6 = Deep established decay, 30-50% of cross section.
4 = Severe decay, nearing failure, more than 50% of the cross section.
0 = Failed.

APPENDIX IIa
INDIVIDUAL SAMPLE DETAILS AFTER 159 WEEKS EXPOSURE

Sample No	OD Wt Calc	Weight Wet	MC %	Ratings			Deflect (mm)	MOE (GPa)
				Mycel	Decay	Mould		
HMC/8-week pre-decay, Copper naphthenate treatment 1 edge								
C61H/1	1738	2197	26	6	4	5.0	4.70	4.09
C61H/2	1695	2224	31	6	6	4.5	3.23	5.70
C61H/3	1648	2033	23	6	4	4.5	4.19	4.53
C61H/4	1667	**Failed 137 weeks**			0		8.00	0.00
C61H/5	1909	2663	39	5	6	4.0	3.10	5.72
C61H/6	1857	**Failed 137 weeks**			0		8.00	0.00
C62H/7	1778	**Failed 84 weeks**			0		8.00	0.00
C62H/8	1733	2818	43	6	6	4.5	2.84	6.59
C62H/9	1972	1951	32	5	4	4.5	4.17	4.41
C62H/10	1606	2764	39	6	6	4.5	2.00	9.06
C62H/11	1593	2558	58	6	4	4.5	4.22	4.45
C62H/12	1490	2491	38	6	4	4.0	3.85	4.58
C62H/13	1745	2359	33	5	6	4.5	2.73	6.99
C62H/14	1680	4324	138	1	8	3.5	1.97	8.99
C62H/15	1678	2357	33	6	4	4.0	2.73	6.67
C62H/16	1564	2780	54	4	7	4.0	2.10	8.97
C62H/17	1759	2432	24	5	7	4.5	2.73	7.09
C62H/18	1605	2336	22	6	4	4.5	3.16	5.73
C62H/19	1932	2158	50	5	4	4.0	3.17	6.00
C62H/20	1717	2303	44	6	6	3.5	3.45	5.43
			43	**5.3**	**4.5**	**4.3**	**3.92**	**5.25**
HMC/8-week pre-decay, Copper naphthenate treatment 2 edges								
C62H/1	1817	2379	31	6	6	4.0	2.79	6.38
C62H/2	1637	2198	34	6	4	4.0	4.80	3.95
C62H/3	1907	2459	29	6	4	4.0	3.08	6.16
C62H/4	1466	1869	27	5	4	4.5	5.03	3.80
C62H/5	1958	2590	32	5	6	4.0	2.41	7.59
C62H/6	1566	2136	36	5	6	4.5	2.96	6.26
C62H/7	1778	**Failed 84 weeks**			0		8.00	0.00
C62H/8	1733	2361	36	6	4	4.0	5.40	3.67
C62H/9	1972	2447	24	6	6	4.5	2.34	7.74
C62H/10	1606	2044	27	6	4	4.0	5.40	3.49
C62H/11	1593	2608	64	4	7	4.5	2.65	7.07
C62H/12	1490	**Failed 159 weeks**			0		8.00	0.00
C62H/13	1745	2478	42	6	4	4.5	4.05	4.52
C62H/14	1680	**Failed 137 weeks**			0		8.00	0.00
C62H/15	1678	2024	21	6	4	5.0	4.40	4.13
C62H/16	1564	1943	24	6	4	4.5	5.90	3.24
C62H/17	1759	2299	31	3	7	4.5	2.10	8.80
C62H/18	1605	2144	34	5	4	5.0	3.04	6.01
C62H/19	1932	2649	37	6	6	4.0	2.35	7.97
C62H/20	1717	2275	32	5	6	4.5	2.41	7.72
			33	**5.4**	**4.3**	**4.4**	**4.26**	**4.93**

APPENDIX IIa (contd.)
INDIVIDUAL SAMPLE DETAILS AFTER 159 WEEKS EXPOSURE

Sample No	OD Wt Calc	Weight Wet	MC %	Ratings			Deflect (mm)	MOE (GPa)
				Mycel	Decay	Mould		
HMC/8-week pre-decay, Copper naphthenate treatment 1 face, 2 edges								
C63H/1	1715	2546	48	4	7	4.0	1.95	9.52
C63H/2	1713	2782	62	6	6	3.5	3.03	6.31
C63H/3	1675	2366	41	6	7	4.5	2.62	7.32
C63H/4	1685	2556	52	2	8	3.5	2.01	8.83
C63H/5	1607	3147	96	5	8	3.0	3.08	6.16
C63H/6	1782	2625	47	6	4	4.5	2.38	7.35
C63H/7	1709	2556	50	2	8	4.0	2.50	7.42
C63H/8	1781	2791	57	5	6	3.5	2.92	6.24
C63H/9	1827	2480	36	5	6	4.0	2.17	8.54
C63H/10	1854	2709	46	6	4	4.5	4.68	4.00
C63H/11	1892	2834	50	5	8	4.5	1.95	9.44
C63H/12	1513	2317	53	1	8	3.0	2.87	6.84
C63H/13	1721	**Failed 137 weeks**			0		8.00	0.00
C63H/14	1968	2802	42	5	7	4.0	1.93	9.42
C63H/15	1614	2210	37	5	6	4.0	2.77	6.99
C63H/16	1736	2317	33	5	8	3.5	2.14	8.35
C63H/17	1804	2711	50	5	6	4.0	2.14	8.71
C63H/18	1770	2383	35	1	8	3.5	2.26	8.49
C63H/19	1801	2522	40	4	7	3.0	2.05	9.16
C63H/20	1598	**Failed 159 weeks**			0		8.00	0.00
			49	**4.3**	**6.1**	**3.8**	**3.07**	**6.95**
HMC/8-week pre-decay, Copper naphthenate treatment 4 sides								
C64H/1	1846	3146	70	3	7	2.5	2.03	9.25
C64H/2	1688	2488	47	1	8	3.0	1.98	9.30
C64H/3	1764	2645	50	1	8	2.5	2.42	7.63
C64H/4	1888	2888	53	4	7	3.0	2.13	8.86
C64H/5	1467	3067	109	1	8	3.0	2.65	7.20
C64H/6	1911	2588	35	1	9	2.0	3.37	5.97
C64H/7	1705	2827	66	1	9	2.5	2.21	8.41
C64H/8	1586	2367	49	4	6	3.0	1.97	9.41
C64H/9	1781	2354	32	1	8	2.0	1.76	10.54
C64H/10	1932	2567	33	3	8	3.0	1.49	12.02
C64H/11	1616	2596	61	1	8	4.0	3.03	6.35
C64H/12	1729	2199	27	3	8	3.0	2.17	8.71
C64H/13	1789	3128	75	1	8	2.5	2.05	9.22
C64H/14	1736	2377	37	1	8	2.0	2.50	7.50
C64H/15	1739	2525	45	4	8	3.0	2.80	6.83
C64H/16	2011	2750	37	6	4	4.0	2.33	7.91
C64H/17	2093	2693	29	4	7	3.5	1.93	9.74
C64H/18	1428	2395	68	1	8	2.5	2.44	7.64
C64H/19	1688	2495	48	5	7	3.0	2.36	7.96
C64H/20	1521	2047	35	1	8	3.0	2.42	7.81
			50	**2.4**	**7.6**	**2.9**	**2.30**	**8.41**

APPENDIX IIa (contd.)
INDIVIDUAL SAMPLE DETAILS AFTER 159 WEEKS EXPOSURE

Sample No	OD Wt Calc	Weight Wet	MC %	Ratings			Deflect (mm)	MOE (GPa)
				Mycel	Decay	Mould		
HMC/8-week pre-decay, Boron treatment 1 edge								
B61H/1	2012	2548	27	5	6	5.0	2.92	6.66
B61H/2	1780	2386	34	4	6	4.5	2.12	8.80
B61H/3	2030	2759	36	5	6	4.5	2.65	7.02
B61H/4	1719	2428	41	4	6	4.5	2.20	8.54
B61H/5	1923	2339	22	6	4	4.0	3.48	5.47
B61H/6	1857	3268	76	5	4	4.0	2.71	6.87
B61H/7	1802	2491	38	5	6	4.5	2.87	6.25
B61H/8	1922	2922	52	2	8	4.5	2.19	8.28
B61H/9	1675	2900	73	5	6	4.5	2.48	7.48
B61H/10	1615	2433	51	4	6	4.5	2.80	6.87
B61H/11	1706	2449	44	5	6	4.5	3.97	4.81
B61H/12	1814	2774	53	6	4	4.5	7.65	2.50
B61H/13	1686	2220	32	4	6	4.5	2.52	7.28
B61H/14	1837	2771	51	5	6	4.5	3.50	5.22
B61H/15	1849	2361	28	6	4	4.5	5.50	3.86
B61H/16	1745	2265	30	4	6	4.5	2.73	7.30
B61H/17	1624	2582	59	4	6	4.5	2.65	6.74
B61H/18	1481	2108	42	4	6	5.0	3.23	5.64
B61H/19	1641	2195	34	5	4	4.5	3.67	5.18
B61H/20	1608	2466	53	5	6	4.5	3.23	5.87
			44	**4.7**	**5.6**	**4.5**	**3.25**	**6.33**
HMC/8-week pre-decay, Boron treatment 2 edges								
B62H/1	2012	2667	33	3	8	4.5	1.55	11.58
B62H/2	1891	3127	65	3	8	4.5	2.87	6.59
B62H/3	1595	2817	77	1	8	4.5	2.23	8.40
B62H/4	1550	2539	64	1	9	4.5	3.82	5.13
B62H/5	1523	2285	50	3	7	4.5	2.97	6.39
B62H/6	1686	2657	58	1	8	4.5	2.16	8.48
B62H/7	1678	2379	42	1	9	4.5	1.91	9.30
B62H/8	1718	2553	49	2	9	4.5	1.97	9.42
B62H/9	1729	2446	41	2	9	4.5	3.72	4.97
B62H/10	1493	2224	49	1	8	4.5	3.26	5.87
B62H/11	1769	2335	32	1	8	4.0	1.61	11.51
B62H/12	1583	2578	63	2	8	4.0	3.30	5.88
B62H/13	1891	2909	54	2	8	4.5	1.95	9.18
B62H/14	1676	3102	85	1	9	4.0	2.02	8.91
B62H/15	1633	2251	38	1	9	4.5	2.48	7.32
B62H/16	1722	2578	50	1	9	4.5	1.80	9.76
B62H/17	1717	2743	60	1	8	4.5	1.95	9.39
B62H/18	1823	2572	41	1	8	4.5	1.99	8.88
B62H/19	1593	2400	51	3	8	4.5	3.09	6.36
B62H/20	1739	2627	51	3	7	4.5	2.15	8.81
			53	**1.7**	**8.3**	**4.4**	**2.44**	**8.11**

APPENDIX IIa (contd.)
INDIVIDUAL SAMPLE DETAILS AFTER 159 WEEKS EXPOSURE

Sample No	OD Wt Calc	Weight Wet	MC %	Ratings			Deflect (mm)	MOE (GPa)
				Mycel	Decay	Mould		
HMC/8-week pre-decay, Boron treatment 1 face, 2 edges								
B63H/1	1974	3187	61	3	8	3.5	1.77	10.40
B63H/2	1746	2351	35	1	8	4.0	2.75	6.82
B63H/3	1840	2603	41	1	9	3.0	1.66	10.81
B63H/4	1713	2440	42	1	8	3.5	2.00	9.21
B63H/5	1568	2682	71	1	8	3.5	2.92	6.84
B63H/6	1888	2556	35	1	9	3.5	1.80	9.98
B63H/7	1848	2570	39	1	9	3.5	1.98	9.11
B63H/8	1838	3481	89	1	9	3.0	1.83	9.53
B63H/9	1748	2912	67	1	9	3.5	2.88	6.41
B63H/10	1538	2333	52	1	8	3.5	2.12	9.00
B63H/11	1868	2993	60	1	9	3.5	2.05	8.75
B63H/12	1664	2385	43	1	9	4.0	2.03	8.94
B63H/13	1869	2553	37	1	9	3.5	1.83	9.91
B63H/14	1867	2811	51	1	9	3.5	1.96	9.37
B63H/15	1476	2368	60	1	8	4.0	2.67	7.26
B63H/16	1684	2547	51	1	9	3.5	2.39	7.62
B63H/17	1762	2680	52	1	8	4.0	2.30	7.85
B63H/18	1734	2691	55	1	8	3.0	2.52	7.86
B63H/19	1764	2733	55	1	9	4.5	1.81	9.89
B63H/20	1642	2333	42	1	9	3.5	2.78	6.37
			52	**1.1**	**8.6**	**3.6**	**2.20**	**8.60**
HMC/8-week pre-decay, Boron treatment 4 sides								
B64H/1	1668	2483	49	1	9	2.5	2.47	7.64
B64H/2	1816	2518	39	1	T	2.5	2.00	9.20
B64H/3	1642	3003	83	1	8	2.5	2.52	7.41
B64H/4	1594	3197	101	1	9	3.0	1.90	9.63
B64H/5	1811	2865	58	1	9	2.5	2.43	7.40
B64H/6	1587	2175	37	1	8	3.0	2.08	8.98
B64H/7	1772	3885	119	1	8	3.0	2.03	9.10
B64H/8	1574	2426	54	1	8	3.0	2.60	7.40
B64H/9	1690	3168	87	1	8	3.0	2.18	8.43
B64H/10	1692	2419	43	1	8	4.0	2.29	8.26
B64H/11	1835	2558	39	1	8	3.0	1.99	9.24
B64H/12	1621	2843	75	1	9	3.5	2.50	7.30
B64H/13	1464	2086	42	1	8	3.0	2.20	8.67
B64H/14	1758	2456	40	1	9	2.5	2.33	7.93
B64H/15	1839	2965	61	1	8	3.0	2.13	8.91
B64H/16	1795	2783	55	1	9	3.5	2.37	7.98
B64H/17	1483	2325	57	1	8	3.0	2.68	7.20
B64H/18	1711	2537	48	1	9	3.0	2.03	9.29
B64H/19	1761	2502	42	1	8	3.0	1.75	10.59
B64H/20	1779	2456	38	1	9	3.5	2.48	7.64
			58	**1.0**	**8.5**	**3.0**	**2.25**	**8.41**

APPENDIX IIa (contd.)
INDIVIDUAL SAMPLE DETAILS AFTER 159 WEEKS EXPOSURE

Sample No	OD Wt Calc	Weight Wet	MC %	Ratings			Deflect (mm)	MOE (GPa)
				Mycel	Decay	Mould		
HMC/4-week pre-decay, Copper naphthenate treatment 1 edge								
C31H/1	1624	**Failed 159 weeks**			0		8.00	0.00
C31H/2	1707	2200	29	6	4	5.0	3.22	5.82
C31H/3	1670	2250	35	4	7	4.5	3.32	5.54
C31H/4	1621	**Failed 137 weeks**			0		8.00	0.00
C31H/5	1862	2333	25	6	6	4.5	7.60	2.57
C31H/6	1941	3482	79	5	7	4.5	2.82	6.51
C31H/7	1997	3088	55	6	6	4.0	3.19	5.89
C31H/8	2008	2559	27	2	9	4.0	2.09	8.94
C31H/9	1761	2532	44	5	6	4.0	3.64	5.04
C31H/10	2043	2760	35	6	7	3.5	2.02	9.04
C31H/11	1595	2869	80	3	7	4.0	2.39	7.59
C31H/12	1811	2264	25	6	4	4.5	3.32	5.55
C31H/13	1769	3531	100	5	4	4.0	2.98	5.96
C31H/14	1724	2285	33	6	6	3.5	2.67	7.06
C31H/15	1490	1950	31	5	6	4.5	4.42	4.18
C31H/16	1768	**Failed 137 weeks**			0		8.00	0.00
C31H/17	1691	2249	33	6	4	4.5	2.96	6.43
C31H/18	1764	2200	25	5	6	4.0	2.55	7.32
C31H/19	1710	2188	28	6	4	5.0	4.92	3.82
C31H/20	1456	**Failed 137 weeks**			0		8.00	0.00
			43	**5.1**	**4.7**	**4.3**	**4.31**	**4.86**
HMC/4-week pre-decay, Copper naphthenate treatment 2 edges								
C32H/1	1553	**Failed 48 weeks**			0		8.00	0.00
C32H/2	1658	**Failed 159 weeks**			0		8.00	0.00
C32H/3	1665	**Failed 137 weeks**			0		8.00	0.00
C32H/4	1923	**Failed 159 weeks**			0		8.00	0.00
C32H/5	1697	2177	28	5	7	4.5	2.79	6.59
C32H/6	1664	**Failed 159 weeks**			0		8.00	0.00
C32H/7	1697	2005	18	6	6	4.5	4.35	4.20
C32H/8	1995	2615	31	5	4	4.5	3.54	5.24
C32H/9	1817	**Failed 159 weeks**			0		8.00	0.00
C32H/10	1901	2554	34	6	6	3.5	2.16	8.99
C32H/11	1795	2463	37	5	7	3.5	2.05	9.00
C32H/12	1678	1994	19	6	4	4.0	4.20	4.55
C32H/13	1987	**Failed 159 weeks**			0		8.00	0.00
C32H/14	1789	2233	25	6	6	4.5	3.50	5.09
C32H/15	1796	2195	22	6	6	4.0	2.67	6.77
C32H/16	1888	2873	52	6	6	4.5	3.62	5.17
C32H/17	1429	1858	30	6	4	4.5	7.00	2.67
C32H/18	1622	**Failed 159 weeks**			0		8.00	0.00
C32H/19	1983	2561	29	4	7	3.5	2.00	9.25
C32H/20	1916	2837	48	5	6	4.0	2.16	8.73
			31	**5.5**	**3.5**	**4.1**	**5.20**	**3.81**

APPENDIX IIa (contd.)
INDIVIDUAL SAMPLE DETAILS AFTER 159 WEEKS EXPOSURE

Sample No	OD Wt Calc	Weight Wet	MC %	Ratings			Deflect (mm)	MOE (GPa)
				Mycel	Decay	Mould		
HMC/4-week pre-decay, Copper naphthenate treatment 1 face, 2 edges								
C33H/1	1819	2314	27	6	6	5	4.36	4.28
C33H/2	1673	2332	39	6	4	3.5	5.18	3.59
C33H/3	1755	2256	29	4	7	4.0	3.01	6.16
C33H/4	1946	2965	52	6	6	3.0	2.39	7.96
C33H/5	2014	3239	61	5	6	3.0	2.30	7.85
C33H/6	1799	2513	40	4	7	4.5	2.73	6.99
C33H/7	1842	3991	117	1	9	3.5	2.11	8.61
C33H/8	1636	2257	38	5	6	4.5	2.72	7.09
C33H/9	1866	2238	20	6	7	3.5	3.35	5.76
C33H/10	2091	2776	33	4	8	4.5	1.73	10.14
C33H/11	1598	3108	94	1	9	2.5	2.46	7.34
C33H/12	1608	2542	58	3	7	3.0	2.62	7.41
C33H/13	1547	2493	61	5	7	3.5	4.42	4.41
C33H/14	1623	2780	71	5	7	4.0	3.02	6.16
C33H/15	1717	3026	76	5	6	3.5	2.75	6.70
C33H/16	1539	2220	44	4	6	3.5	3.74	5.21
C33H/17	1634	2400	47	4	8	4.0	2.37	7.80
C33H/18	1748	2313	32	5	6	4.5	3.46	5.34
C33H/19	1509	2270	50	6	4	4.0	4.40	4.40
C33H/20	1761	2378	35	6	4	4.0	3.02	6.03
			51	**4.6**	**6.5**	**3.8**	**3.11**	**6.46**
HMC/4-week pre-decay, Copper naphthenate treatment 4 sides								
C34H/1	1756	2356	34	6	6	4.5	2.58	7.14
C34H/2	1576	2143	36	1	9	2.5	3.18	5.74
C34H/3	1577	**Failed 137weeks**			0		8.00	0.00
C34H/4	1737	2430	40	3	8	3.0	2.23	8.30
C34H/5	1830	2492	36	5	7	3.5	2.39	7.64
C34H/6	1997	2690	35	5	8	3.0	2.70	6.89
C34H/7	1633	**Failed 159 weeks**			0		8.00	0.00
C34H/8	1684	2289	36	4	7	2.5	3.39	5.42
C34H/9	1722	2762	60	5	4	3.0	2.41	7.60
C34H/10	1608	2390	49	5	7	3.0	3.10	6.18
C34H/11	1802	2356	31	1	10	2.0	1.96	9.72
C34H/12	1557	2058	32	4	8	2.5	3.18	6.19
C34H/13	1873	2433	30	6	8	3.5	2.35	7.71
C34H/14	1489	2202	48	1	9	3.0	2.34	8.16
C34H/15	1783	2684	51	4	8	3.0	2.85	6.45
C34H/16	1806	2637	46	6	6	3.5	2.46	7.52
C34H/17	1869	2424	30	5	6	3.0	2.89	6.41
C34H/18	1737	2775	60	6	4	3.0	2.55	7.20
C34H/19	1899	2768	46	1	9	2.0	1.71	10.54
C34H/20	1540	3076	100	1	9	2.5	2.82	6.96
			44	**3.8**	**6.7**	**2.9**	**3.15**	**6.59**

APPENDIX IIa (contd.)
INDIVIDUAL SAMPLE DETAILS AFTER 159 WEEKS EXPOSURE

Sample No	OD Wt Calc	Weight Wet	MC %	Ratings			Deflect (mm)	MOE (GPa)
				Mycel	Decay	Mould		
HMC/4-week pre-decay, Boron treatment 1 edge								
B31H/1	1782	**Failed 159 weeks**			0		8.00	0.00
B31H/2	1836	2640	44	4	6	5.0	5.55	3.27
B31H/3	2053	2858	39	5	6	4.0	2.67	6.92
B31H/4	1733	2459	42	4	6	4.5	3.25	6.07
B31H/5	1624	2402	48	5	4	4.5	4.22	4.76
B31H/6	1607	2203	37	6	4	4.5	5.40	3.78
B31H/7	1556	**Failed 137 weeks**			0		8.00	0.00
B31H/8	1569	2060	31	5	4	4.5	4.97	3.95
B31H/9	1592	2717	71	5	7	3.5	3.02	6.34
B31H10	1922	2565	33	4	6	4.5	2.32	7.81
B31H/11	1676	2874	71	5	4	4.5	4.02	4.67
B31H/12	1694	2812	66	6	4	4.5	6.05	3.16
B31H/13	1742	2354	35	6	4	5.0	3.64	5.10
B31H/14	1664	2233	34	5	4	4.5	4.03	4.69
B31H/15	1735	2305	33	5	6	4.5	2.56	7.23
B31H/16	1585	2425	53	5	4	4.0	4.65	4.16
B31H/17	1647	2394	45	6	4	4.5	5.05	3.84
B31H/18	1835	2620	43	4	7	4.5	2.10	8.85
B31H/19	1697	2092	23	6	4	4.0	3.55	5.08
B31H/20	1789	2344	31	4	7	4.5	2.05	9.17
			43	**5.0**	**4.6**	**4.4**	**4.26**	**4.94**
HMC/4-week pre-decay, Boron treatment 2 edges								
B32H/1	1735	3438	98	1	T	4.5	3.50	5.32
B32H/2	1761	2406	37	1	9	4.5	1.97	9.17
B32H/3	1766	2394	36	1	T	4.5	1.82	9.86
B32H/4	1662	2468	48	1	8	4.5	2.27	8.24
B32H/5	1963	3390	73	1	9	4.5	2.09	8.46
B32H/6	1760	2281	30	1	T	4.0	2.12	8.55
B32H/7	1782	2423	36	4	T	4.0	2.14	8.59
B32H/8	1742	2693	55	2	9	4.5	2.41	7.72
B32H/9	1816	2645	46	1	9	4.5	1.96	9.21
B32H/10	1630	2789	71	1	T	3.5	2.60	7.28
B32H/11	1721	2248	31	3	7	4.5	1.95	9.67
B32H/12	1997	2791	40	1	9	4.0	1.79	10.11
B32H/13	1869	3394	82	5	6	4.5	2.13	8.70
B32H/14	1878	2548	36	4	7	4.5	2.13	8.87
B32H/15	1629	3144	93	1	9	4.0	2.43	7.46
B32H/16	1457	2061	41	1	9	4.5	3.29	5.73
B32H/17	1743	2718	56	1	T	4.5	3.09	6.10
B32H/18	1789	2411	35	1	9	4.5	2.15	8.66
B32H/19	1806	2837	57	1	9	4.5	2.43	7.78
B32H/20	1495	2143	43	4	8	4.5	3.08	6.09
			52	**1.8**	**8.9**	**4.4**	**2.37**	**8.08**

APPENDIX IIa (contd.)
INDIVIDUAL SAMPLE DETAILS AFTER 159 WEEKS EXPOSURE

Sample No	OD Wt Calc	Weight Wet	MC %	Ratings			Deflect (mm)	MOE (GPa)
				Mycel	Decay	Mould		
HMC/4-week pre-decay, Boron treatment 1 face, 2 edges								
B33H/1	1599	2702	69	1	T	3.5	2.58	7.03
B33H/2	1843	2459	33	1	T	3.5	1.66	11.04
B33H/3	1561	2131	37	1	10	3.0	3.67	4.94
B33H/4	1813	2529	39	1	T	4.0	2.05	9.02
B33H/5	1845	2560	39	1	10	3.5	3.24	5.77
B33H/6	1781	2753	55	1	9	3.5	2.55	7.54
B33H/7	1695	2351	39	1	T	4.0	2.01	9.14
B33H/8	1816	2682	48	1	10	3.5	2.63	6.98
B33H/9	1793	2531	41	1	T	3.5	1.86	10.07
B33H/10	1615	2536	57	1	T	3.5	2.3	7.93
B33H/11	1644	2181	33	1	T	3.0	2.85	6.66
B33H/12	1861	2794	50	1	T	4.0	2.03	9.21
B33H/13	1703	2399	41	1	9	3.5	2.03	9.04
B33H/14	1837	2594	41	1	T	4.0	1.60	11.24
B33H/15	1964	3481	77	1	9	3.5	2.02	8.97
B33H/16	1630	2588	59	1	9	3.5	2.85	6.66
B33H/17	1809	3357	86	1	T	4.0	2.17	8.48
B33H/18	1744	2442	40	1	T	3.5	1.78	10.25
B33H/19	1685	2433	44	1	T	4.0	2.24	8.31
B33H/20	1546	2271	47	1	T	3.5	3.02	6.39
			49	**1.0**	**9.8**	**3.6**	**2.36**	**8.23**
HMC/4-week pre-decay, Boron treatment 4 sides								
B34H/1	1623	2512	55	1	T	2.5	2.88	6.37
B34H/2	1871	3380	81	1	T	3.5	1.73	10.45
B34H/3	1469	2404	64	1	9	2.5	2.32	8.23
B34H/4	1936	2697	39	1	T	3.0	3.10	6.04
B34H/5	1809	2670	48	1	T	3.0	2.27	8.35
B34H/6	1471	2147	46	1	9	2.0	2.88	6.77
B34H/7	1791	2935	64	1	9	3.0	1.68	10.85
B34H/8	1793	2528	41	4	T	3.0	2.18	8.27
B34H/9	1816	2485	37	1	T	3.0	1.90	9.88
B34H/10	1758	2923	66	1	9	2.0	1.75	10.39
B34H/11	1822	2707	49	1	9	3.5	1.80	10.16
B34H/12	1666	2394	44	1	9	2.5	2.25	8.44
B34H/13	1671	2893	73	1	9	2.5	1.93	9.71
B34H/14	1492	2132	43	1	9	2.5	2.93	6.54
B34H/15	1868	4252	128	1	9	3.0	1.85	9.82
B34H/16	1804	2701	50	1	T	2.5	2.05	8.81
B34H/17	2125	3258	53	1	9	3.0	1.80	10.20
B34H/18	1621	2291	41	1	9	3.0	2.14	9.01
B34H/19	1635	2566	57	4	9	2.0	2.70	6.96
B34H/20	1737	2708	56	1	T	3.0	2.62	7.65
			57	**1.3**	**9.4**	**2.8**	**2.24**	**8.64**

APPENDIX IIa (contd.)
INDIVIDUAL SAMPLE DETAILS AFTER 159 WEEKS EXPOSURE

Sample No	OD Wt Calc	Weight Wet	MC %	Ratings			Deflect (mm)	MOE (GPa)
				Mycel	Decay	Mould		
HMC/4-week pre-decay, Boron H1.2 Commercial treatment								
B3H/1	1481	2694	82	1	10	2.0	3.26	5.72
B3H/2	1507	2488	65	1	10	2.5	4.98	3.72
B3H/3	1263	2684	113	1	10	2.0	5.45	3.63
B3H/4	1356	2622	93	1	10	4.0	3.48	5.60
B3H/5	1344	2387	78	1	10	2.0	3.33	5.68
B3H/6	1511	2805	86	1	10	2.5	4.05	4.63
B3H/7	1504	2614	74	1	10	3.0	4.03	4.72
B3H/8	1554	2885	86	1	10	2.5	3.65	5.25
B3H/9	1514	3102	105	1	10	2.5	3.86	4.80
B3H/10	1533	2263	48	1	10	2.0	5.27	3.44
B3H/11	1537	2573	67	1	10	2.5	4.07	4.55
B3H/12	1404	1881	34	1	10	2.5	3.40	5.65
B3H/13	1546	2296	49	1	10	2.0	6.14	3.14
B3H/14	1468	3506	139	1	10	2.5	2.97	6.54
B3H/15	1617	2285	41	1	10	2.0	3.18	6.06
B3H/16	1404	2542	81	1	10	2.5	2.96	6.32
B3H/17	1493	2928	96	1	10	3.5	3.08	6.30
B3H/18	1262	2645	110	1	10	2.5	4.30	4.56
B3H/19	1411	2476	75	1	10	4.0	3.36	5.75
B3H/20	1351	2639	95	1	10	3.0	3.74	5.27
			81	**1.0**	**10.0**	**2.6**	**3.93**	**5.07**
HMC/4-week pre-decay, Untreated controls								
U3H/1	1775	**Failed 137 weeks**			0		8.00	0.00
U3H/2	2026	**Failed 137 weeks**			0		8.00	0.00
U3H/3	1579	1966	25	5	6	4.5	3.60	5.25
U3H/4	1875	**Failed 159 weeks**			0		8.00	0.00
U3H/5	1545	**Failed 108 weeks**			0		8.00	0.00
U3H/6	1695	2255	33	4	7	4.5	3.40	5.54
U3H/7	1821	2542	40	4	8	4.5	2.28	8.42
U3H/8	1650	**Failed 137 weeks**			0		8.00	0.00
U3H/9	1662	**Failed 108 weeks**			0		8.00	0.00
U3H/10	1985	**Failed 84 weeks**			0		8.00	0.00
U3H/11	1774	2453	38	5	6	4.5	6.56	2.92
U3H/12	1830	2715	48	6	4	4.5	4.75	3.96
U3H/13	1813	**Failed 108 weeks**			0		8.00	0.00
U3H/14	1727	2110	22	5	6	4.5	2.11	8.95
U3H/15	1624	2030	25	5	7	4.5	3.13	5.77
U3H/16	2038	**Failed 137 weeks**			0		8.00	0.00
U3H/17	1907	2316	21	6	4	4.5	2.97	6.37
U3H/18	1472	1867	27	6	4	3.5	4.98	3.83
U3H/19	1600	**Failed 137 weeks**			0		8.00	0.00
U3H/20	1490	1946	31	6	4	4.5	3.63	4.95
			31	**5.2**	**2.9**	**4.4**	**5.76**	**2.95**

APPENDIX IIa (contd.)
INDIVIDUAL SAMPLE DETAILS AFTER 159 WEEKS EXPOSURE

Sample No	OD Wt Calc	Weight Wet	MC %	Ratings			Deflect (mm)	MOE (GPa)
				Mycel	Decay	Mould		
HMC/not pre-decayed, Untreated controls								
UMH/1	1738	2566	48	1	10	4.5	2.82	6.76
UMH/2	1806	2635	46	1	10	5.0	1.84	9.96
UMH/3	1906	2546	34	4	7	4.5	2.10	8.52
UMH/4	1653	2800	69	2	9	5.0	2.24	8.03
UMH/5	1660	2412	45	5	7	3.5	2.98	6.41
UMH/6	1724	2404	39	3	8	5.0	3.32	5.70
UMH/7	1940	2376	22	6	7	5.0	2.55	7.35
UMH/8	1635	3305	102	4	8	5.0	3.39	5.63
UMH/9	1932	2785	44	3	9	5.0	2.03	8.87
UMH/10	1887	2686	42	2	9	4.0	1.78	10.48
UMH/11	1558	2512	61	2	9	4.5	3.13	6.38
UMH/12	1581	**Failed 159 weeks**			0		8.00	0.00
UMH/13	1683	2582	53	1	10	5.0	3.03	6.26
UMH/14	1849	2392	29	4	8	4.5	1.90	9.58
UMH/15	1594	2515	58	3	8	4.5	2.65	7.04
UMH/16	2019	2936	45	3	9	4.5	1.86	9.82
UMH/17	1752	2438	39	3	8	5.0	2.59	7.33
UMH/18	1889	3353	78	5	7	4.0	2.08	8.87
UMH/19	1963	**Failed 137 weeks**			0		8.00	0.00
UMH/20	1936	2713	40	1	10	4.0	1.98	9.22
			50	**2.9**	**7.7**	**4.6**	**3.01**	**7.11**

APPENDIX IIb
INDIVIDUAL SAMPLE DETAILS AFTER 157 WEEKS EXPOSURE

Sample No	OD Wt Calc	Weight Wet	MC %	Ratings			Deflect (mm)	MOE (GPa)
				Mycel	Decay	Mould		
LMC/12-week pre-decay, Copper naphthenate treatment 2 edges								
C62L/1	1741	2002	15	5	6	4.5	2.49	7.60
C62L/2	1568	1908	22	3	7	4.5	2.62	7.32
C62L/3	1865	2264	21	3	7	4.5	1.81	10.63
C62L/4	1693	**Failed 135 weeks**			0		8.00	0.00
C62L/5	1845	2067	12	5	6	4.5	3.63	5.29
C62L/6	1601	**Failed 40 weeks**			0		8.00	0.00
C62L/7	1552	**Failed 84 weeks**			0		8.00	0.00
C62L/8	1760	2067	17	4	6	4.0	2.10	9.13
C62L/9	1691	2101	24	3	8	4.5	2.54	7.79
C62L/10	1419	1957	38	1	8	4.0	2.87	6.92
			21	**3.4**	**4.7**	**4.4**	**4.21**	**5.47**
LMC/12-week pre-decay, Copper naphthenate treatment 4 sides								
C64L/1	1645	2192	33	3	8	3.5	3.08	5.82
C64L/2	1861	2309	24	1	8	4.0	1.84	10.48
C64L/3	1740	2089	20	3	8	4.5	1.94	9.71
C64L/4	1898	2180	15	3	7	4.0	1.58	12.06
C64L/5	1937	2152	11	1	7	4.5	2.03	9.35
C64L/6	1728	1858	8	1	8	4.5	2.41	7.90
C64L/7	1622	1916	18	3	8	4.0	4.84	3.92
C64L/8	1689	1938	15	1	7	4	3.26	6.02
C64L/9	1692	2124	26	1	8	3.5	1.87	10.30
C64L/10	1699	2038	20	1	8	4.5	2.96	6.55
			19	**1.8**	**7.7**	**4.1**	**2.58**	**8.21**
LMC/12-week pre-decay, Boron treatment 2 edges								
B62L/1	1640	2041	24	1	8	3.5	1.88	10.28
B62L/2	1975	2443	24	3	8	4.0	1.64	11.34
B62L/3	1892	2246	19	5	6	4.0	1.74	10.83
B62L/4	1768	2214	25	3	8	4.0	1.98	9.47
B62L/5	1907	2376	25	3	8	3.5	1.76	10.84
B62L/6	1630	2205	35	4	7	4.5	3.31	5.73
B62L/7	1661	2071	25	3	8	4.0	2.96	6.74
B62L/8	1763	2209	25	2	8	3.5	1.81	10.56
B62L/9	1718	2166	26	3	8	4.5	2.95	6.56
B62L/10	1739	1995	15	5	4	4.5	7.08	2.78
			24	**3.2**	**7.3**	**4.0**	**2.71**	**8.51**

APPENDIX IIb (contd.)
INDIVIDUAL SAMPLE DETAILS AFTER 157 WEEKS EXPOSURE

Sample No	OD Wt Calc	Weight Wet	MC %	Ratings			Deflect (mm)	MOE (GPa)
				Mycel	Decay	Mould		
LMC/12-week pre-decay, Boron treatment 4 sides								
B64L/1	1798	2282	27	1	8	2.0	1.61	11.85
B64L/2	1637	2076	27	1	8	2.0	2.49	7.83
B64L/3	1758	2214	26	1	8	2.0	1.90	9.76
B64L/4	1573	2052	30	1	8	2.0	2.38	8.08
B64L/5	1715	2249	31	1	9	2.0	2.34	8.34
B64L/6	1681	2127	27	1	8	2.5	1.91	9.82
B64L/7	1612	2087	29	1	9	2.0	3.54	5.25
B64L/8	1811	2728	51	1	8	3.5	2.88	6.65
B64L/9	1709	2147	26	1	8	2.0	1.76	10.89
B64L/10	1837	2350	28	1	8	2.0	2.74	6.80
			30	**1.0**	**8.2**	**2.2**	**2.36**	**8.53**
LMC/7-week pre-decay, Copper naphthenate treatment 2 edges								
C32L/1	1589	2024	27	1	T	4.0	2.37	7.70
C32L/2	1884	1980	5	6	4	4.5	3.27	5.69
C32L/3	1663	**Failed 135 weeks**			0		8.00	0.00
C32L/4	1684	2091	24	1	9	4.0	2.11	9.08
C32L/5	1825	2101	15	6	4	5.0	3.06	6.25
C32L/6	1879	2116	13	5	6	4.5	2.52	7.50
C32L/7	1518	1914	26	1	8	4.0	2.71	7.34
C32L/8	1584	1911	21	5	4	4.5	2.38	7.87
C32L/9	1728	2148	24	1	9	4.5	2.54	7.43
C32L/10	1986	2346	18	4	7	5.0	3.89	5.17
			19	**3.3**	**6.1**	**4.4**	**3.29**	**6.40**
LMC/7-week pre-decay, Copper naphthenate treatment 4 sides								
C34L/1	1753	2186	25	1	8	2.5	1.90	9.86
C34L/2	1843	2280	24	1	8	4.5	1.71	11.04
C34L/3	1605	2058	28	1	9	4.0	2.39	7.90
C34L/4	1959	1983	1	1	9	4.5	2.28	8.16
C34L/5	1789	2256	26	1	8	3.0	1.87	10.20
C34L/6	1810	2268	25	1	8	3.5	2.87	6.64
C34L/7	1725	2163	25	1	8	4.0	1.83	10.40
C34L/8	1838	2376	29	1	8	4.0	2.08	9.02
C34L/9	1662	2070	25	1	8	3.0	2.86	6.95
C34L/10	1579	1974	25	1	8	4.0	2.00	9.76
			23	**1.0**	**8.1**	**3.7**	**2.18**	**8.99**

APPENDIX IIb (contd.)
INDIVIDUAL SAMPLE DETAILS AFTER 157 WEEKS EXPOSURE

Sample No	OD Wt Calc	Weight Wet	MC %	Ratings			Deflect (mm)	MOE (GPa)
				Mycel	Decay	Mould		
LMC/7-week pre-decay, Boron treatment 2 edges								
B32L/1	1750	2247	28	1	9	4.5	2.07	9.07
B32L/2	1862	2290	23	4	7	4.0	1.85	10.09
B32L/3	1685	2132	27	1	T	4.0	2.59	7.33
B32L/4	1765	2198	25	1	9	3.5	1.72	10.88
B32L/5	1687	2122	26	1	9	4.0	2.03	9.51
B32L/6	1973	2512	27	1	9	3.5	1.61	11.54
B32L/7	1702	2136	25	1	9	4.5	2.90	6.56
B32L/8	1636	2057	26	1	9	2.0	2.63	7.28
B32L/9	1729	2422	40	3	7	4.5	2.57	7.22
B32L/10	2037	2536	24	3	7	4.0	1.79	10.57
			27	**1.7**	**8.3**	**3.9**	**2.18**	**9.01**
LMC/7-week pre-decay, Boron treatment 4 sides								
B34L/1	1799	2411	34	1	9	3.5	1.78	10.47
B34L/2	1738	2168	25	1	9	2.0	2.48	7.84
B34L/3	1569	2101	34	1	T	3.0	2.40	7.91
B34L/4	1556	1982	27	1	8	2.0	2.14	8.78
B34L/5	1699	2137	26	1	9	2.0	2.13	9.05
B34L/6	1705	2148	26	1	8	2.0	2.72	7.17
B34L/7	1329	1695	28	1	8	2.0	3.17	6.18
B34L/8	1755	2231	27	1	9	2.0	2.50	7.60
B34L/9	1630	2039	25	1	8	2.0	2.13	9.08
B34L/10	1794	2298	28	1	8	2.0	2.10	9.01
			28	**1.0**	**8.4**	**2.3**	**2.36**	**8.31**
LMC/7-week pre-decay, Boron H1.2 Commercial treatment								
B3L/1	1500	1924	28	1	10	2.0	3.92	4.91
B3L/2	1463	2003	37	1	10	2.0	3.93	4.95
B3L/3	1490	1908	28	1	10	2.0	2.55	7.80
B3L/4	1497	1873	25	1	10	2.0	3.52	5.62
B3L/5	1407	1783	27	1	10	2.0	2.99	6.66
B3L/6	1424	1873	32	1	10	2.0	3.13	6.21
B3L/7	1299	1663	28	1	10	2.0	4.23	4.61
B3L/8	1429	1792	25	1	10	2.5	3.56	5.32
B3L/9	1351	1711	27	1	10	2.0	3.39	5.65
B3L/10	1478	2770	87	1	10	2.5	7.05	2.66
			34	**1.0**	**10.0**	**2.1**	**3.83**	**5.44**

APPENDIX IIb (contd.)
INDIVIDUAL SAMPLE DETAILS AFTER 157 WEEKS EXPOSURE

Sample No	OD Wt Calc	Weight Wet	MC %	Ratings			Deflect (mm)	MOE (GPa)
				Mycel	Decay	Mould		
LMC/7-week pre-decay, Untreated controls								
U3L/1	1656	2068	25	3	8	3.5	1.72	10.92
U3L/2	1689	2000	18	4	4	4.5	2.63	7.05
U3L/3	1775	2170	22	3	8	4.0	1.67	11.51
U3L/4	1553	**Failed 107 weeks**			0		8.00	0.00
U3L/5	1770	**Failed 84 weeks**			0		8.00	0.00
U3L/6	1729	1986	15	5	6	5.0	4.06	4.74
U3L/7	1524	**Failed 56 weeks**			0		8.00	0.00
U3L/8	1637	1931	18	4	7	4.0	2.51	7.37
U3L/9	1779	2053	15	5	4	4.5	2.89	6.59
U3L/10	1588	1932	22	3	7	4.5	2.34	8.36
			19	**3.9**	**4.4**	**4.3**	**4.18**	**5.65**
LMC/not pre-decayed, Untreated controls								
UML/1	1729	**Failed 84 weeks**			0		8.00	0.00
UML/2	1614	1991	23	1	10	4.0	2.66	7.54
UML/3	1570	2036	30	1	10	4.5	2.44	7.93
UML/4	1911	2178	14	6	4	4.5	3.35	5.90
UML/5	1679	2082	24	3	7	4.0	2.19	8.63
UML/6	1716	2153	25	1	10	4.5	2.37	8.09
UML/7	1464	1811	24	5	4	4.5	2.97	6.42
UML/8	2099	2660	27	1	10	4.5	1.65	10.97
UML/9	1738	2191	26	1	10	4.0	2.15	8.91
UML/10	1688	2103	25	1	10	4.0	2.38	8.04
			24	**2.2**	**7.5**	**4.3**	**3.02**	**7.24**