EFFECT OF PRESTEAMING ON MOISTURE LOSS AND INTERNAL CHECKING IN HIGH-TEMPERATURE-DRIED BOARDS OF EUCALYPTUS GLOBULUS AND EUCALYPTUS REGNANS.

S.C. Chafe[1] and Ruben A. Ananias[2]

[1]CS/RO, Division of Forestry and Forest Products, Clayton, Victoria, Australia.

[2]Universidad del Bio Bio. Concepción, Chile.

SUMMARY

The presteaming of green boards of' *Eucalyptus regnans* at 100°C for 1,2,4 and 8 hours caused a reduction in drying rate during high-temperature drying; an increase in drying rate was observed for *E. globulus* when moisture 1ess was based on moisture content (M) after presteaming, no significant increase was evident. For boards of radial / intermediate grain orientation, a positive relation ship between average evaporable moisture available (E) during drying and basic density showed density to be a negative influence on drying rate

Internal checking showed little reduction as a consequence of presteaming except in material of tangential grain orientation. This, and an increase in checking at shorter preheating times in material of radial/intermediate orientation, were consistent with results of earlier experiments examining the effect of preheating boards of E. *regnans* in water.

INTRODUCTION

The steaming of wood prior to drying has generally been considered to reduce drying time and increase drying rate (Campbell 1961; Ellwood and Erickson 1962; Lee and Jung 1985; Haslett and Kininmonth 1986). The action of such treatment produces a putative increase in permeability (Mackay 1971; Chen 1975; Cutter and Phelps 1986) thought to be caused by conformational changes in wood extractives (Kininmonth 1971; Alexiou et al. 1990). Recoverable collapse has also been found to be related to wood extractives (Chafe 1987,1990b).

In *E. globulus*, Ananias et al. (1995) determined that preheating in writer-saturated air improved collapse recovery but produced need only a marginal increase in drying rate. In *E. regnans*, Chafe (1995b) found no evidence that preheating improved drying rate; rather, during continuous drying; the drying rate decreased with greater heat exposure. According to Simpson (1975), the length of presteaming time required to improve drying rate (05 to 12h) is not crucial, i.e. shorter periods are as effective as longer periods.

Presteaming has also been used to reduce internal checking (Campbell 1961; Lee and Jung 1985). Preheating in water, although accompanied by an increase in shrinkage and collapse during drying (Chafe 1992, 1993, 1995a), significantly reduced internal checking in *E. regnans* (Chafe 1994, 1995a), a result in line with the findings of Hassled (1986). Prolonged exposure to steaming also increases initial shrinkage and collapse (Greenhill 1938; Campbell 1961), and Chafe (1990a) found that only 30 minutes of presteaming was sufficient to cause such increase in small samples.

The present investigation was carried out to determine whether presteaming, and the length of treatment, effected changes in the drying rate and in the level of internal checking. Boards of plantation-grown *E. globulus* from Chile and boards of regrowth *E. regnans* from Australia were used in the study. Because high-temperature drying is being explored as an alternative option for hardwood drying in Chile, a rigorous schedule was employed here.

MATERIALS AND METHODS

Radially sawn, green boards, ca. 12 cm wide and 3 cm thick, from each of three trees of 40-year-old, plantation-grown Eucalyptus globulus L. from Lota, 8m region, Chile, and similar boards [ca. 11 x 3 cm) from three trees of 55-year-old Eucalyptus regnans F. Muell regrowth from Victoria, Australia were used in the study. Boards were cut into 10 segments ca. 30 cm long along the grain, allowing two replicates for each of four presteaming times (1, 2, 4, and 8h) and a control. All board segments were end-coated with silicon and metal foil, measured in width and thickness, and weighed prior to presteaming for their allotted times at 100°C at atmospheric pressure. Remeasurements and weighing were carried out after presteaming and samples were rapidly kiln-dried (110°C drybulb, 90°C wet bulb) for ca. 24h prior to oven drying to constant weight. Weights and dimensions of all boards were taken at ca. 4, 19.5 and 25h, and after oven drying.

Internal checking was determined using image analysis software developed by J. Ilic, CSIRO. Two-millimeter-thick cross-sections were cut from the centre of oven-dry boards and number (Nv) and area (Ai) of checks were measured on the cross-sectional face. Shrinkage of internal checking was calculated as

$$S_{vi} = 100A_I/Ag$$

where Ag = green cross-sectional area, and external shrinkage was calculated as

$$S_v = 100(Ag-Ao)/Ag$$

where Ao = oven-dry cross-sectional area.

Moisture contents at each measuring time (before steaming (M_b), after steaming (M_a), and after 4, 19.5 and 24 h drying) and basic density were also calculated. Moisture loss (M_l) after each drying time was calculated as the difference between initial moisture content and moisture content at the drying time. These values were calculated using both M_b and M_a as the initial moisture content.

Evaporable moisture available (E) was also calculated by

$$E = 100(M-EMC)/(M_i-EMC)$$ where

M = moisture content,

EMC = equilibrium moisture content = 4.6% for 110°C dry bulb and 90 º C wet bulb,

and

M_i= initial moisture content.