INDUSTRY TRENDS IN CHIP STORAGE AND HANDLING

Tim McDonald
Research Engineer
USDA Forest Service
520 DeVall Drive
Auburn, AL 36849-5418

Alastair Twaddle
R & D Manager – Wood Quality
International Paper Co.
PO Box 87
Cantonment, FL 32533

ABSTRACT

A survey was conducted of US pulp and paper mills to characterize chip pile management trends. The survey was developed by members of the TAPPI Fiber Raw Material Supply Committee and mailed out in December of 1999. There were a total of 80 respondents to the survey. A typical mill was found to maintain one softwood and one hardwood chip pile, with maximum inventory of less than 25,000 green tons each. Chip transport to piles was most often via conveyors and recovery typically using dozers to a pit reclaim. Pile inventory method was dependent on mill size, but tended to be by visual inspection. Conversion of pile volume to weight was predominately through a constant factor of unknown origin. Important losses in chip quality varied by region, with brightness losses being the major concern in the West, fungal and size losses in the North, and by-product losses in the South.

INTRODUCTION

Wood yards often are viewed as black boxes at pulp and paper mills throughout the United States. It is difficult to track inventory of purchased feedstock through the wood yard, and there is little published information on losses in wood volume or quality occurring between the chipper and digester. Significant inventory can also be tied up in chip piles and there are few published comparisons of accuracy and cost of inventory measurement systems.

The TAPPI Fiber Raw Material Supply Committee felt it was important to begin documenting how wood chips are handled in order to begin developing improved practices for tracking chip quality and inventory through wood yards. A survey form was developed and mailed in December 1999 to wood yard supervisors at all known wood consuming mills in the US. The survey asked questions about mill size, about the number of chip piles, how piles were built, maintained, and reclaimed, and about pile inventory management strategies. Mills were also asked what losses in quality were most important, and what chip characteristics were measured before pulping. Surveys were returned to a neutral party responsible for compiling and summarizing the results. This paper is a report on the results of the survey.

RESULTS

A total of 152 survey forms were mailed to mills in the United States. Data from 1996 [1] indicated that there were about 191 wood-consuming mills in the US at that time, 33 percent in the Northeast and Northcentral states (NE/NC), 51 percent in the South, and 16 percent in the West. Of the surveys mailed, a total of 80 were returned and another 5-10 mills were found to have closed or did not consume wood chips. The regional distribution of responses was consistent with the geographic distribution of mills: 29 percent from NE/NC states, 58 percent from the South, and 13 percent from the West. Although the response rate was not what had been hoped for, the returned surveys were felt to adequately represent conditions in the pulp and paper industry as it exists in the US today.

Mill size varied by region of the country, with smaller mills (consuming < 2000 green tons of wood per day) concentrated in the NE/NC region, and larger mills (consumption > 6000 green tons per day) more common in the South and West (see Figure 1). There were also regional differences in process, with mills in the West more likely to use continuous kraft or thermomechanical pulping (TMP), while batch kraft mills were more common in the South and NE/NC (see Figure 2).

Nearly 60 percent of the mills returning surveys maintained 2 chip piles (see Figure 3). Mills from the West, however, had a nearly uniform distribution of number of piles (Figure 4) and were as likely to

maintain more than 4 piles as 2. About 52 percent of all reported piles were softwood, 40 percent hardwood, with the balance being residue or reject piles. Piles contained predominately less than 25,000 tons of chips at both maximum and minimum inventory (Figure 5). The pile size distribution was nearly the same for both hardwood and softwood. Over 60 percent of respondents indicated that weight of chips going to the digester was tracked using belt scales. This figure was higher (nearly 80 percent) for large mills. Feed auger speed was used by about 10 percent of respondents, and some combination of procedures used by about 15 percent.

Inventory. Nearly 80 percent of piles were maintained at a minimum inventory for a period of less than 15 days, and 60 percent at a maximum inventory for the same period of time (Figure 6). Reported frequency of maximum and minimum inventory distributions are shown in Figure 7. Maximum inventories tended to be maintained during winter months, and minimum in the summer. Most mills (about 30 percent) reported pile inventory turnover occurred on a monthly rotation, with weekly, monthly, and biannual draw down about equally represented at 15 percent each. Weekly draw down was most common in the South and NE/NC.

Pile handling. Piles were most commonly built using conveyors (Figure 8). Reclaim for piles not built using a stacker-reclaimer was predominately by dozer to a pit (80 percent). Over 97 percent of piles were not covered, and over 70 percent were worked using vehicles (dozer or loader). A few piles built using stacker-reclaimers were also reported to be occasionally worked using dozers. Nearly all mills restricted pile height, mostly for safety, or because of equipment overhanging the pile area or limitations in pile building capabilities.

Pile inventory. All but 4 respondents indicated some type of estimation procedure for chip pile inventory, with visual and ground surveys being the most common approaches (about 25 percent for each). Aerial survey and visual/ground survey plus belt scales were next in frequency with between 10 and 15 percent each, and the remainder mostly some combination of visual survey with ground or aerial survey on a less frequent basis. Frequency of estimation was not asked in the survey, an unfortunate oversight on our part. Survey method was somewhat related to mill size (Figure 9), with larger mills tending to use visual surveys and smaller mills a ground-based survey. Over 80 percent of responding mills performed some type of conversion of pile volume to weight, with a constant factor conversion being the most common approach (Figure 10). The survey form included a place to indicate the source of conversion procedures and about 20 percent of respondents provided some indication of the derivation of their volume-to-weight conversion factors. Half reported using an historical figure, in one case a figure provided by a surveyor. The other half arrived at the conversion using experience and testing procedures, mainly some type of inventory adjustment from usage records, but some from sampling chip moisture and density from the digester feed stream. One respondent indicated that a depth-sensitive factor was actually measured, but no indication was given as to the frequency of the measurement. One respondent indicated chip production was estimated by backing it out from total weight of wood processed less bark production, but no method was given for how actual chip density was determined.

Pile losses. Nearly 70 percent of mills indicated concerns over losses occurring during storage in piles. Overall, loss types were nearly evenly distributed among size, fungal, by-product, and brightness degrades, although there were regional trends in which losses were most important (Figure 11). Size and fungal degrades were the major concern of NE/NC mills, size and by-product loss the major concerns in the South, and mills in the West were most concerned with brightness loss.

Size degrade was the most common loss concern expressed by respondents (about 35 percent of cases), so it was not surprising that most mills measured chip size distribution of piled inventory (about 70 percent, see Figure 12). It was surprising, however, that very few mills elected to track any other measure of chip quality besides moisture content. Fewer than 25 percent of mills tracked wood density, and less than 10 percent of mills measured chip acidity, caustic solubility, buffer capacity, or brightness at any time. Those that did measure chip characteristics tended to track them on a daily or weekly basis.

References

1. " Annual pulpwood statistics summary report 1996 – a compilation of annual receipt and inventory data for the year 1996," APA Publication 97-A-12, American Pulpwood Association (Now known as Forest Resources Association), Rockville, MD, 1997.

Figures

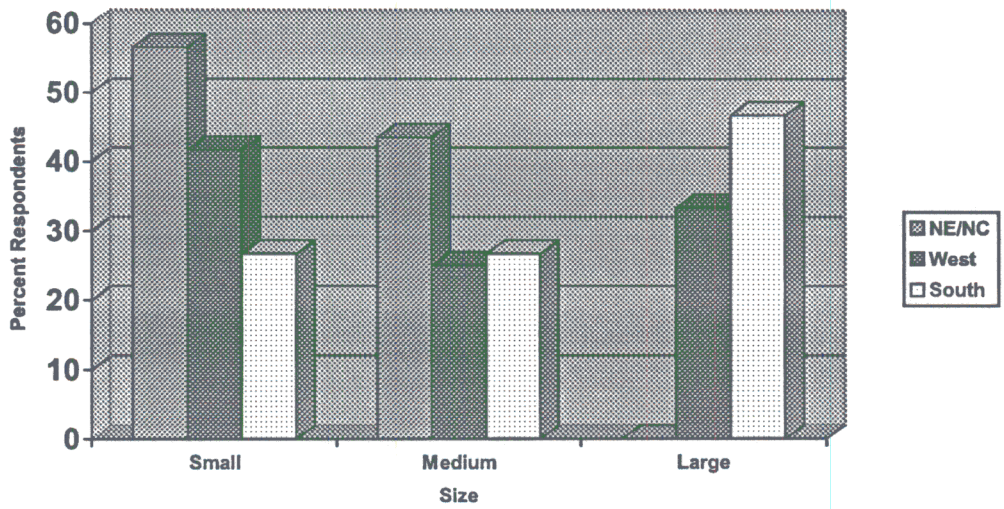

Figure 1. Distribution of mill size by geographic region. Small mills were those consuming less than 2000 green tons per day of wood, and large were those consuming more than 6000 green tons per day.

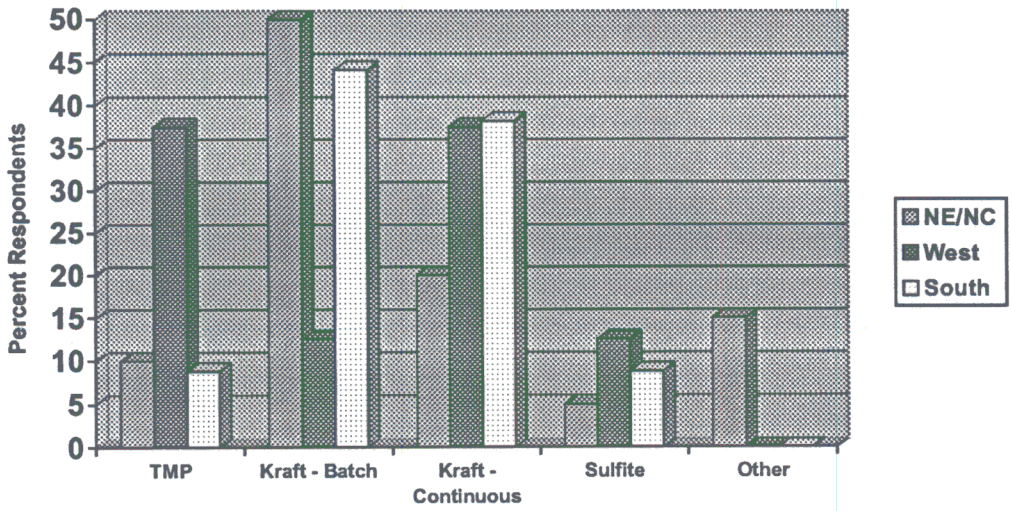

Figure 2. Pulping process as a function of geographic region.

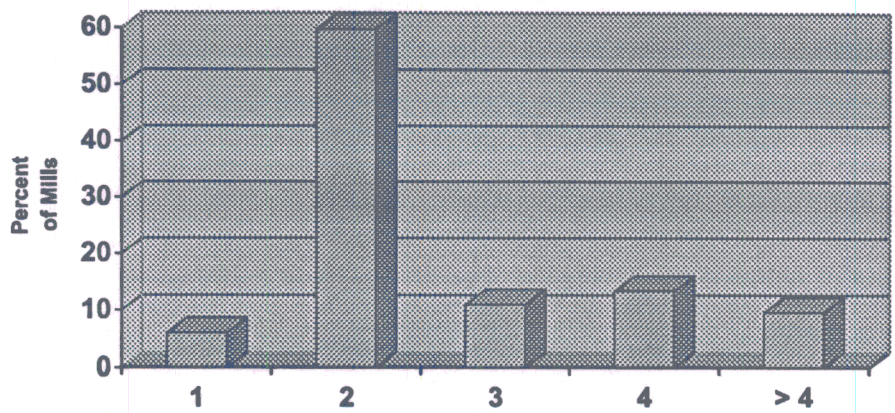

Figure 3. Distribution of reported number of piles maintained at wood consuming mills.

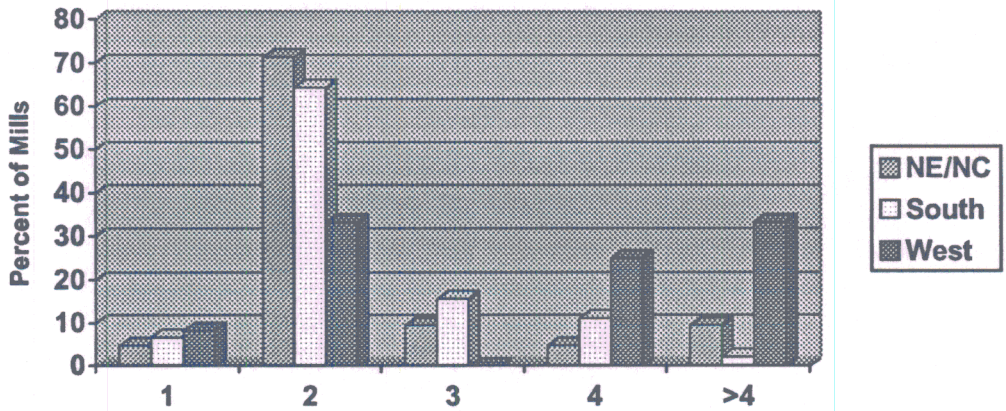

Figure 4. Distribution of number of piles maintained at mills, reported by geographic region.

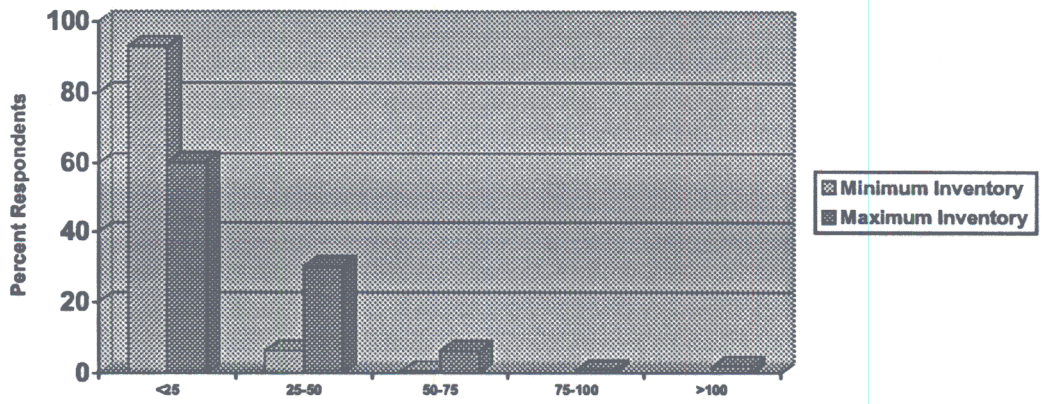

Figure 5. Maximum and minimum pile size distribution. Pile size is in green tons/1000.

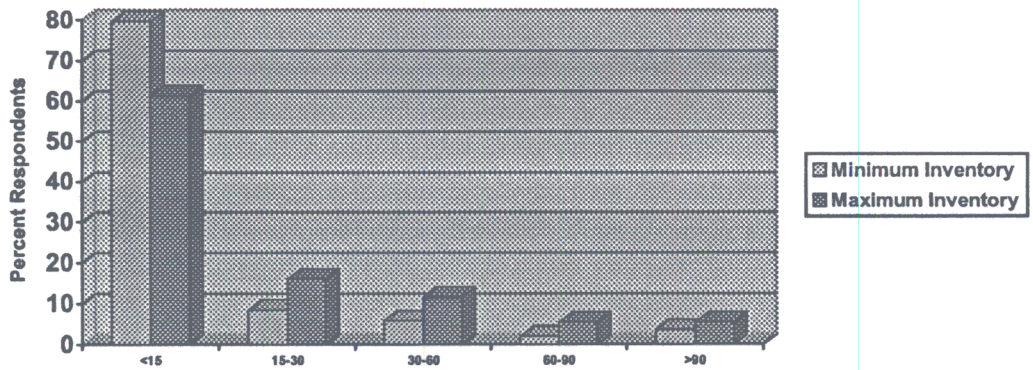

Figure 6. Duration of maximum and minimum inventories, in days.

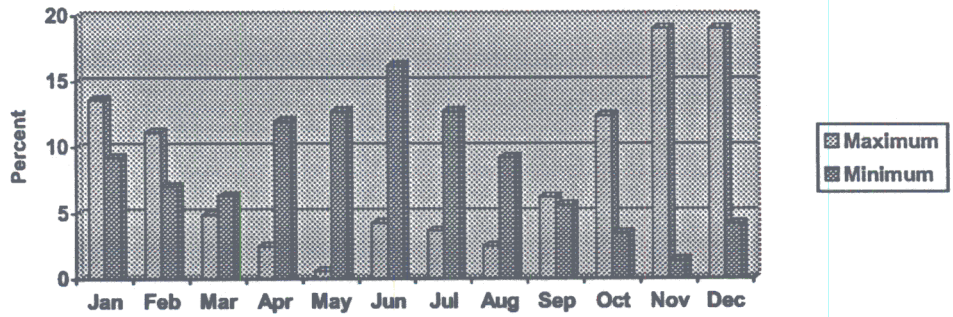

Figure 7. Distribution of reported maximum and minimum inventories by month of the year.

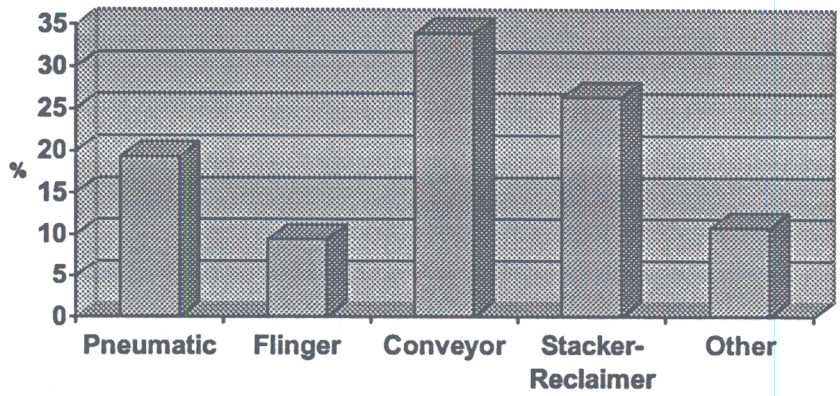

Figure 8. Distribution of chip conveyance method to piles.

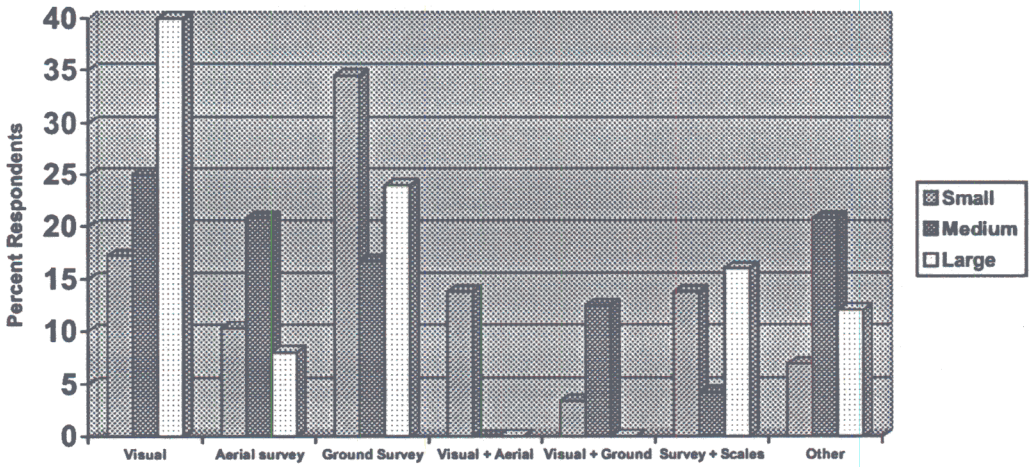

Figure 9. Chip pile inventory survey method, by mill size.

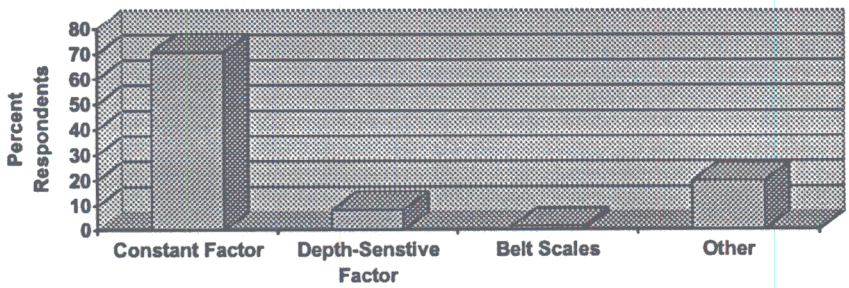

Figure 10. Methods used to convert pile volume to weight of material.

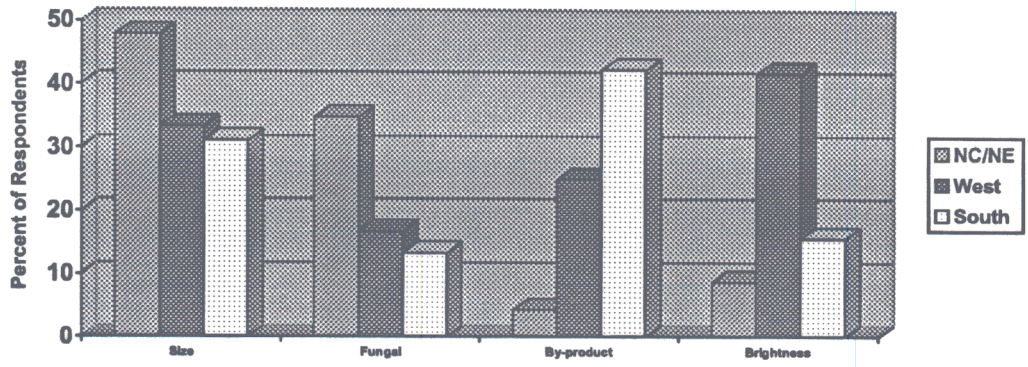

Figure 11. Distribution of quality loss concerns, by geographic region.

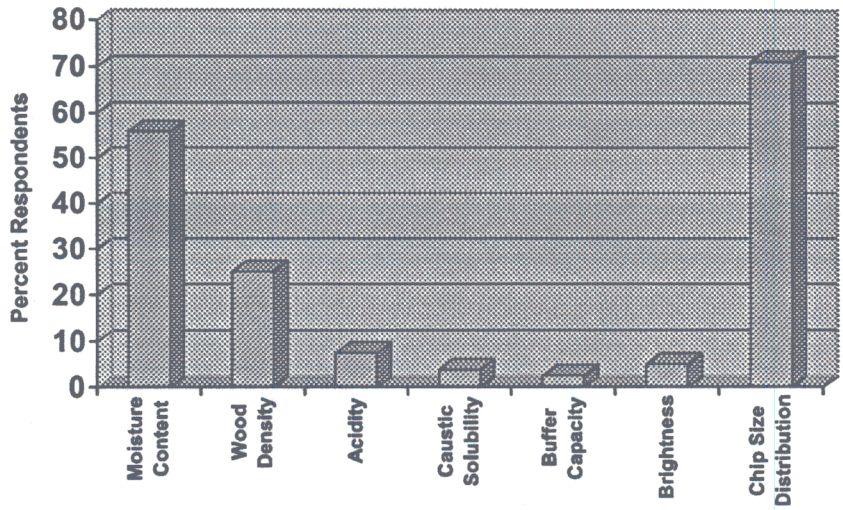

Figure 12. Percent of respondents indicating that the specified chip characteristics were measured.