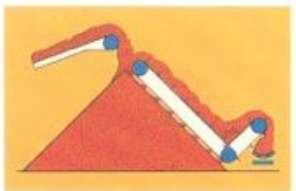
Demand for better pulp means mills must improve the quality and uniformity of wood chips in digester furnish.

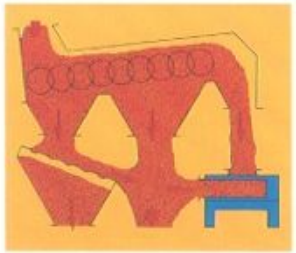
How proper chip handling and preparation improve pulp quality and save money

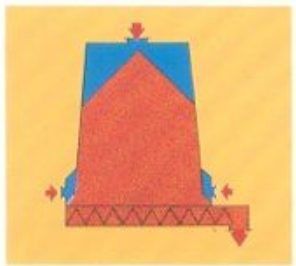
Since the early 1950s, chip *quantity*—not quality—has been the key consideration in designing chip storage, preparation, and handling systems for pulp mills. But now, with rising wood costs, increased demand for better quality pulp, and tighter process standards (thanks to S.P.C.), mills are being forced to take a second look at how they store, reclaim, and process wood chips.

According to *Tappi Journal* (March 1986): "In chemical pulping, emphasis is being placed on uniform wood and chip quality. Mixing chips through large chip piles and screening chips by thickness is now the practice in several mills worldwide." Desigining or retrofitting woodyards with efficient, integrated chip handling systems increases the quality of the chips—and ultimately, the pulp—produced. Such systems provide end-to-end control of chip processing including:

- storage and reclamation
- screening
- presteaming.







The three key phases of chip preparation are storage and reclamation, thickness screening, and presteaming. RETEC offers you process expertise in all three areas.

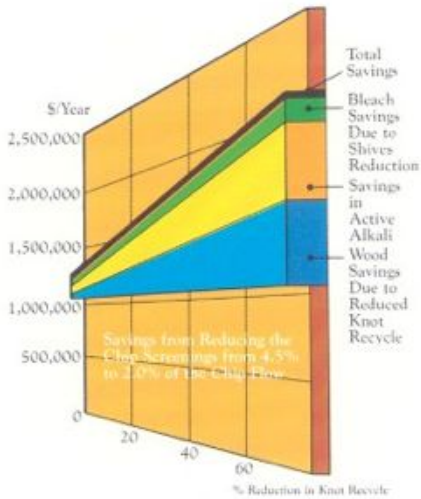
The major benefits of improving chip handling in your mill:

■ *Higher yield.* Controlling chip thickness reduces screened pulp reject losses and ensures uniform cooking, increasing yield. For example, chip thickness screening can increase the total yield of screened pulp in an 823.6 British TPD pulp mill by approximately 1.4%—as reported in *Southern Pulp & Paper* (November, 1983).

■ *Better pulp quality.* Short-term fluctuations in chip quality have a negative effect on K number. This takes place during 8 to 15% of the total cooking time, according to a report in *Pulp & Paper* (November, 1985). Proper chip inventory, reclamation, and screening techniques prevent this fluctuation, stabilizing K number and improving both the consistency and strength of the end product.

■ *Lower chemical consumption.* Chips discolor with age. FIFO inventory control techniques ensure that chips are used in a timely manner, preventing discoloration. In turn, this reduces bleaching requirements and the associated chemicals consumed.

■ *Fewer knotter rejects.* A recent independent study by a leading consulting firm indicates that installing a chip screening system in a 750 metric tons per day kraft pulp mill can reduce the knotter rejects flow by 50% or more.



Removing overthick chips and knots from digester feed can save a 750 air dry tons per day pulp mill approximately $1.75 million per year.

■ *Reduced power demand.* Uniform presteaming reduces energy costs by recycling waste steam to "predigest" chips prior to cooking. In an 800 tons per day pulp mill, a $500,000 annual savings was achieved.

■ *More precise control of cooking.* Chip screening eliminates oversize chips which take longer to cook as well as fines that can produce a soft cook and weaker end product.

■ *Longer equipment life.* By removing rocks and other hard materials that can damage equipment, chip thickness screening systems reduce wear and tear. In one installation, a system equipped with a rock separator extended plate life in the base hot stock refiners from an average of 400 hours per plate to better than 1,030 hours per plate.

■ *Lower fiber costs.* An automated chip handling system can provide

FACTS every papermaker should know about chip handling

The cost of *fiber* is the single largest cost factor in the production of pulp. Demand for pulpable wood is projected to increase 62% between now and the year 2000.

B*ulldozers* and pneumatic conveying systems create 3–4% sawdust and damage up to 3% of chips. Automated reclaimer systems prevent this damage from occurring.

W*ood chips* lose 1% of their usable fiber content for every month in storage. Therefore, a specific chip should be stored no longer than 30 days.

A *15–30 day inventory* of chips is usually sufficient when the supply to the mill is relatively constant and reliable.

P*ractical chip thickness range* is 2 to 8 mm. *Oversize* chips must be screened and cut to size. Fines should be eliminated because they increase digester costs and adversely affect product quality. A good *screening system* can remove 80 percent or more of fines less than 2 mm.

The maximum content of *overthick chips* in the flow to the digest should not exceed 2%. Slicing overthicks to desired thickness can increase total yield up to 2%.

The *optimum temperature* for presteaming chips is 210°F. Presteaming eliminates fluctuations in K number, improving quality.

If wood is soluble in hot 1% sodium hydroxide solution, this indicates significant *fungal decay*. Faster turnover and FIFO inventory control can prevent this decay from occurring.

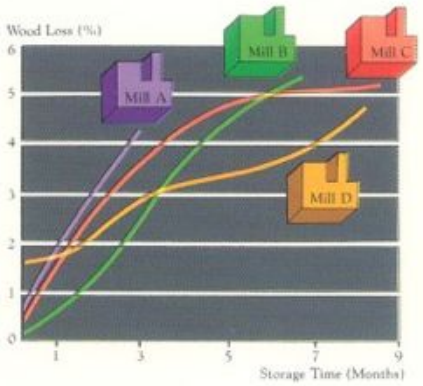
Pulp with fiber strength of more than *10% below average* is likely to cause problems in the paper mill. Proper chip preparation ensures that chips in the furnish have the maximum fiber length (and strength) possible, resulting in greater paper strength.

About 50% of the *tall oil* content of wood chips is lost in the first two months of storage. A FIFO automated chip handling system can help reduce this loss.

Bulldozers damage chips as they run over the wood pile. Automated chip handling systems eliminate this problem, saving money through conservation of usable fiber.

accurate metering of different wood species to the pulp mill. Precise metering of hardwood chips into a softwood supply at one southern mill has substantially reduced the cost of the furnish.

■ *Faster R.O.I.* A CS750,000 chip handling system at one bleached kraft pulp mill in British Columbia achieved a 3-month payback, with cost savings of CS15.21 per ton. And according to a respected study, other large pulp mills can expect similar savings in the range of $6 to $18 per ton of production.



Wood chips lose approximately 1% of usable fiber per month in storage.

Planning your woodyard storage requirements

If your chip supply is consistent and reliable, a 15 to 30-day inventory of wood chips is normally sufficient. As you know, the goal is to prevent wood chips from deteriorating while ensuring that a ready supply is always on-hand. Reason: As chips age, the fiber deteriorates. Wood chips lose approximately 1% of usable fiber for every month of storage. Fungal decay and compaction cause chips to splinter, producing soft cooks.

In addition, prolonged storage also causes discoloration, which adds to chemical and energy costs required for bleaching. Uneven coloring also contributes to loss of process control, adversely affecting the uniformity of the end product.

A key to efficient chip storage is the use of FIFO ("First-In, First-Out") inventory control. Automated reclaimers move through the chip pile to achieve an even blend of chips to the furnish, preventing the random fluctuation of chips that can occur when bulldozers are used. Other reasons not to use bulldozers include high operating and maintenance costs plus fiber loss caused by chip damage and scattering.

Automated chip handling systems eliminate these problems. Studies indicate that installing an overhead stacker/reclaimer in a 1,200 tons per day mill with a 30-day chip turnover will save $5 million and provide a 3-year payback—just based on wood conservation alone.

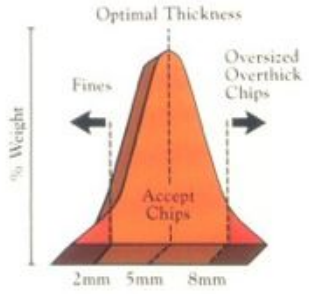
Chip thickness screening gives you uniform quality, higher yields.

Studies of pulp mills worldwide (see reference list, p. 4) indicate that the optimum chip thickness range is 5 to 6 mm. This suggests that the practical accept limits be set for a range no broader than 2 to 8 mm.

Chip thickness controls cooking uniformity. Variations in chip thickness cause over and under-cooking of chips—adversely affecting product quality and yield.

Fines cause circulation problems in continuous digesters. Pulp made from fines has lower yield and inferior strength (due to the shorter fiber lengths). As you know, the wood supply to most digesters should preferably contain no more than 1 percent fines.

Chip uniformity also affects process control and production



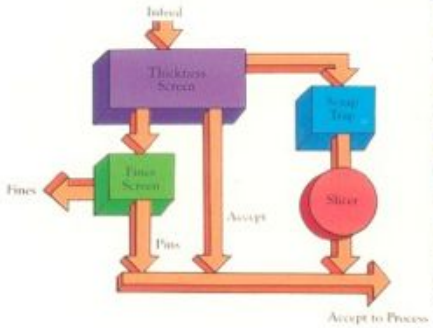
Acceptable chip thickness for most mills is 2 to 8 mm.

capacity. More densely packed chips mean more wood-per-volume in the furnish and consequently can increase digester production up to 10%, according to *Pulp & Paper* (July 1984). In a 1,000 tons per day mill, increasing digester capacity as a result of chip screening resulted in annual cost savings of $2 million (see *Pulp & Paper Journal*, January 1986).

Chip screening systems ensure that chips fed to the digester are consistent in thickness, thus eliminating undesirable variations in fiber quality. This variation can upset Statistical Process Control systems and prevent the papermaker from achieving the desired degree of uniformity in the final end-product. Chip thickness screening systems also save money by recovering and recycling overs and pins that would otherwise go to the reject pile. For example, a 3% recovery of usable fiber by the screening system in a 2,000 tons per day mill will save approximately $570,000 per year (assuming a chip cost of $28 per ton).

Presteaming: using process or exhaust steam to increase your cooking efficiency

Presteaming—the injection of steam into chips prior to processing—evacuates air, causing greater chip compaction and resulting in increased digester yield. Also, uniform temperature (approximately 210 degrees Fahrenheit) and moisture minimize fluctuations in Kappa number. Tests from one Finnish kraft mill indicate that K number variations can be decreased from ±19 percent (without presteaming) to ±4.7 percent (with presteaming). This results in more precisely controlled cooking times, which ultimately decreases energy consumption. Further, if process or exhaust steam which would otherwise be vented to atmosphere is used, additional energy savings can be achieved.



RETEC chip thickness screening system separates accepts from overs, fines, pins, and rocks. Overs are sent to the slicer and cut to acceptable dimensions.

RETEC's V-V Stacker/Reclaimer is built specifically for the "continuous-use" requirements of the pulp and paper industry. An oversized center bearing simplifies maintenance and enhances system reliability.

RETEC's presteaming system increases digester capacity, allowing higher quality pulp to be made using less energy.

A key requirement of chip screening is to prevent loss of usable fiber. RETEC chip screening systems are designed to meet this requirement with special "flip-flow" screens that recover pins from the fines chip flow and return the pins to the accept material flow for pulping.

In Chile, RETEC designed an open-air storage system for hardwood and softwood using two TSR-16 reclaimers and an overhead stack-out conveyor.

RETEC was one of the first companies to offer traveling screw reclaimers to the North American pulp and paper industry, and today RETEC's TSR™ is the most widely used traveling screw reclamation system. A tapered screw pulls chips evenly from the various layers in the chip pile, ensuring uniform in-pile blending.

Bottom line: Presteaming increases capacity in both batch and continuous digesters, allowing the same tonnage pulp to be produced using less steam—thus reducing energy costs.

Presteaming is also advantageous for thermomechanical pulp and chemithermomechanical pulp plants. In these plants, the purpose of presteaming is to remove internal air from the wood chips and to stabilize chip temperature. Air in the chips hinders impregnation in two ways: First, the air pockets inhibit liquor uptake. Tests have shown that after 2 minutes, there is approximately 30 percent more sodium sulfite in presteamed chips than in unsteamed chips. Second, once the liquor is in the chips, the chemicals cannot diffuse across the air pockets.

Since air pockets prevent chemicals from reacting with the wood, parts of the chips will remain untreated by the chemical addition. It has been documented that if untreated areas are present, the shive content increases rapidly and the quality of the pulp is lowered.

Open-air RETEC storage system at a southern U.S. mill containing 2 million cubic feet of chips. Two 90-foot stackers and a 125-foot reclaimer move along this 900-foot pile, ensuring even turnover of chip inventory.

Put our chip handling expertise to work in your mill.

All RETEC storage, reclamation, screening, and presteaming systems are designed specifically for pulp and paper mill requirements. Our systems are built for continuous, reliable operation and have a high degree of automation to reduce labor costs. Other advantages of RETEC technology include: FIFO inventory control, accurate species mixing (to reduce raw material costs), controlled blending, direct process feed, increased pulp quality, lower energy consumption, and reliable chip flow.

For specific information on how RETEC can design a system meeting the chip handling requirements of your installation, call our chip handling specialists today at (404) 448-6655.

"RETEC supplied the traveling screw reclaimer and presteaming system for our CTMP mill. They were very cooperative and the equipment performs well," says Jean Guy Saudageau, Mill Manager of Domtar, Dolbeau, Québec.

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