# How is Paper Recycled?

## Sorting

Successful recycling requires clean recovered paper, so you must keep your paper free from contaminants, such as food, plastic, metal, and other trash, which make paper difficult to recycle. Contaminated paper which cannot be recycled must be composted, burned for energy, or landfilled. Recycling centers usually ask that you sort your paper by grade, or type of paper. Your local recycling center can tell you how to sort paper for recycling in your community. To locate your nearest dealer, look in the yellow pages of your phone book under “waste paper” or “recycling.”

## Collection and Transportation

You may take your sorted paper to a local recycling center or recycling bin. Often, a paper stock dealer or recycling center will collect recovered paper from your home or office. Your local dealer can tell you the options available in your community.

At the recycling center, the collected paper is wrapped in tight bales and transported to a paper mill, where it will be recycled into new paper.

## Storage

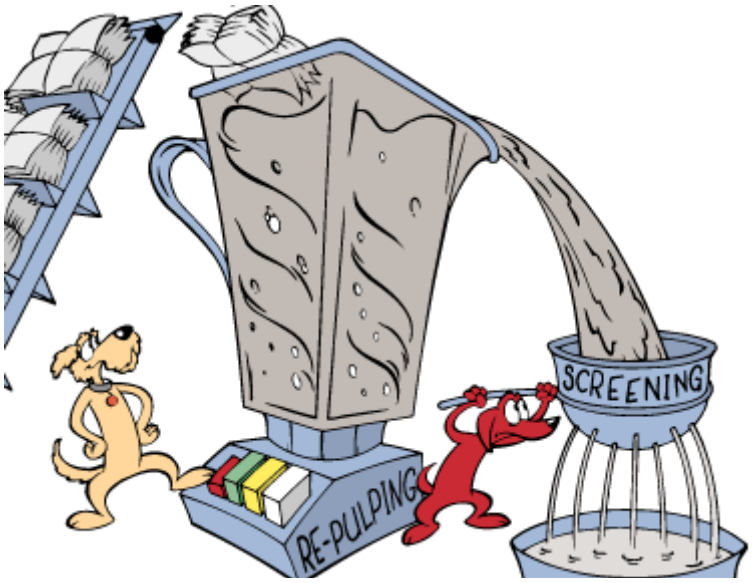
Paper mill workers unload the recovered paper and put it into warehouses, where it is stored until needed. The various paper grades, such as newspapers and corrugated boxes, are kept separate, because the paper mill uses different grades of recovered paper to make different types of recycled paper products.

When the paper mill is ready to use the paper, forklifts move the paper from the warehouse to large conveyors.


## Re-pulping and Screening

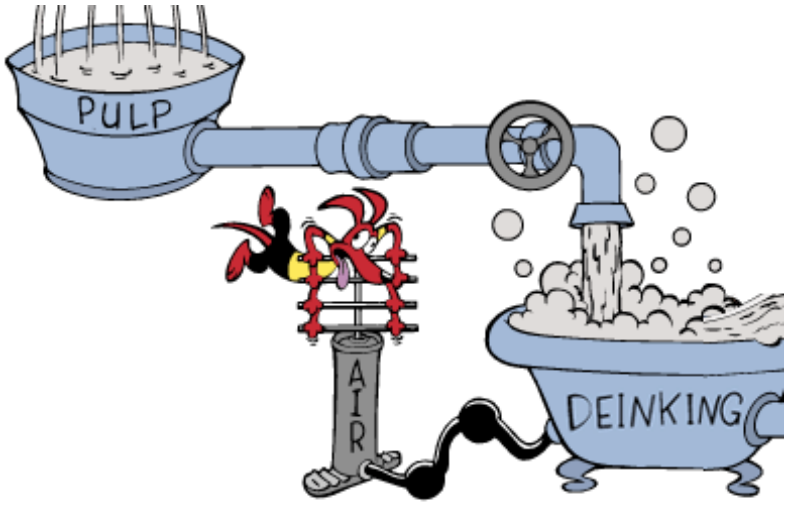
The paper moves by conveyor to a big vat called a pulper, which contains water and chemicals. The pulper chops the recovered paper into small pieces. Heating the mixture breaks the paper down more quickly into tiny strands of cellulose (organic plant material) called fibers. Eventually, the old paper turns into a mushy mixture called pulp.

The pulp is forced through screens containing holes and slots of various shapes and sizes. The screens remove small contaminants such as bits of plastic and globs of glue. This process is called screening.



## Cleaning

Mills also clean pulp by spinning it around in large cone-shaped cylinders. Heavy contaminants like staples are thrown to the outside of the cone and fall through the bottom of the cylinder. Lighter contaminants collect in the center of the cone and are removed. This process is called cleaning.




## Deinking

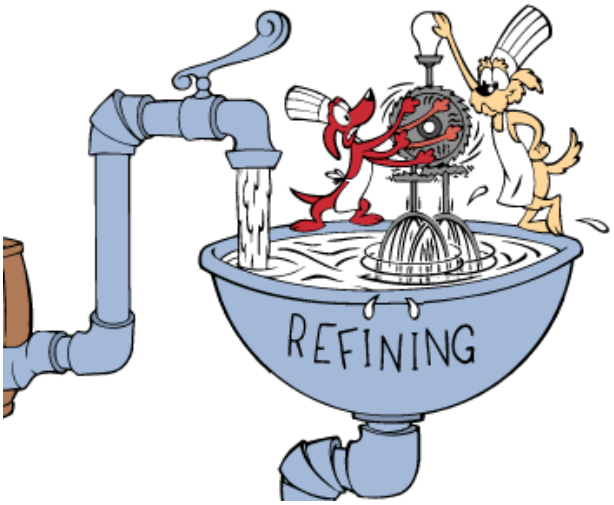
Sometimes the pulp must undergo a “pulp laundering” operation called deinking (de-inking) to remove printing ink and “stickies” (sticky materials like glue residue and adhesives). Papermakers often use a combination of two deinking processes. Small particles of ink are rinsed from the pulp with water in a process called washing. Larger particles and stickies are removed with air bubbles in another process called flotation.

During flotation deinking, pulp is fed into a large vat called a flotation cell, where air and soap-like chemicals call surfactants are injected into the pulp. The surfactants cause ink and stickies to loosen from the pulp and stick to the air bubbles as they float to the top of the mixture. The inky air bubbles create foam or froth which is removed from the top, leaving the clean pulp behind.

## Refining, Bleaching and Color Stripping

During refining, the pulp is beaten to make the recycled fibers swell, making them ideal for papermaking. If the pulp contains any large bundles of fibers, refining separates them into individual fibers. If the recovered paper is colored, color stripping chemicals remove the dyes from the paper.

Then, if white recycled paper is being made, the pulp may need to be bleached with hydrogen peroxide, chlorine dioxide, or oxygen to make it whiter and brighter. If brown recycled paper is being made, such as that used for industrial paper towels, the pulp does not need to be bleached.




## Papermaking

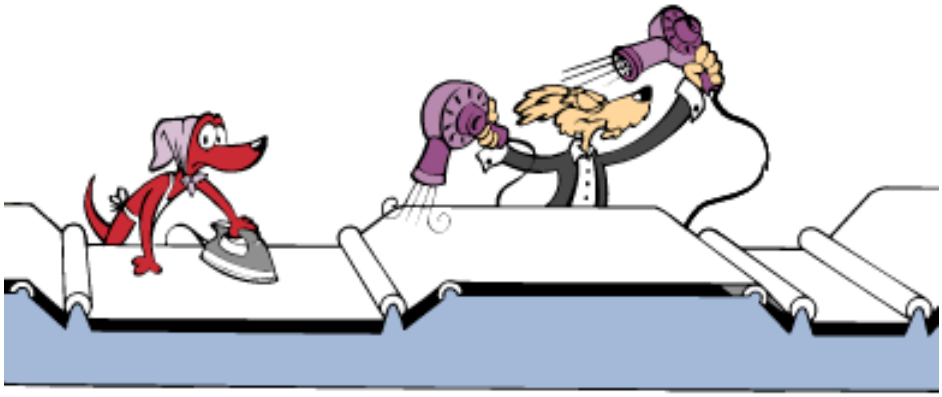
Now the clean pulp is ready to be made into paper. The recycled fiber can be used alone, or blended with new wood fiber (called virgin fiber) to give it extra strength or smoothness.

The pulp is mixed with water and chemicals to make it 99.5% water. This watery pulp mixture enters the headbox, a giant metal box at the beginning of the paper machine, and then is sprayed in a continuous wide jet onto a huge flat wire screen which is moving very quickly through the paper machine.

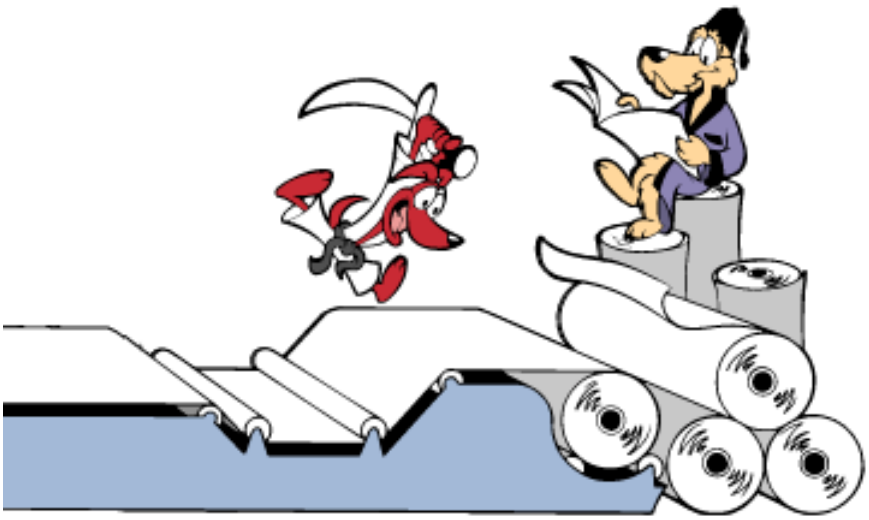

On the screen, water starts to drain from the pulp, and the recycled fibers quickly begin to bond together to form a watery sheet. The sheet moves rapidly through a series of felt-covered press rollers which squeeze out more water.

## Papermaking (cont.)

The sheet, which now resembles paper, passes through a series of heated metal rollers which dry the paper. If coated paper is being made, a coating mixture can be applied near the end of the process, or in a separate process after the papermaking is completed. coating gives paper a smooth, glossy surface for printing.



Finally, the finished paper is wound into a giant roll and removed from the paper machine. One roll can be as wide as 30 feet and weigh as much as 20 tons! The roll of paper is cut into smaller rolls, or sometimes into sheets, before being shipped to a converting plant where it will be printed or made into products such as envelopes, paper bags, or boxes.



## Can all of my recovered paper be recycled?

As much as 80% of the content of typical recovered paper can actually be used in the recycling process, but 20% cannot. A lot of what's contained in a bale of recovered "paper" isn't paper! Trash, such as wire, staples, paper clips, and plastic, must be removed during pulping, cleaning, and screening. This trash is usually sent to a landfill, just like your trash at home.

Recovered paper contains some fibers which have become too small to be recycled into paper. Your recovered paper may contain fibers which already have been recycled one, twice, or perhaps several times! Wood fibers can only be recycled five to seven times before they become too short and brittle to be made into new paper.

Recovered paper contains many other ingredients which are not paper fibers. Just take a look at a magazine and you'll see what we mean. The printed pages contain lots of ink. If the pages are shiny, that portably means they are coated with clay or other materials. Magazines also contain adhesives which bind the pages together. Ink, coatings, and adhesives must be removed from the paper before recycled paper can be produced.

## What happens to the ink once it is removed from the paper?

As you have learned, ink and stickies are trapped in the froth produced during flotation deinking. This material is collected, and much of its water is removed and reused in the mill.

The remaining material, which is still 30%-50% water, also contains very small fibers which have washed out of the pulp during the deinking process.

This material can be burned to make energy, composted, or land filled. It can also be used to make concrete and gravel for roads. The disposal method depends upon the material's content. In a typical deinking plant, every 100,000 dry lbs. of recovered paper placed in the pulper will result in as much as 35,000 dry lbs. of ink, stickies, and small fiber.

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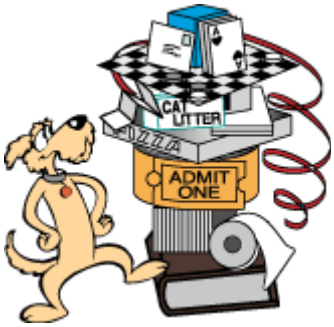
## What can be made from recovered paper?




Most recovered paper is recycled back into paper and paperboard products. With a few exceptions, recovered paper is generally recycled into a grade similar to, or of lower quality than, the grade of the original product. For example, old corrugated boxes are used to make new recycled corrugated boxes. Recovered printing and writing paper can be used to make new recycled copy paper.

Recovered paper can be used in a variety of other products as well. Recycled pulp can be molded into egg cartons and fruit trays. Recovered paper can be used for fuel, ceiling and wall insulation, paint filler, and roofing. Nearly 100,000 tons of shredded paper is used each year for animal bedding. Even cat litter can be made from recovered paper!

## Did you know...

- That the world's first piece of paper was made from recycled material? That's right! Around 200 B.C., the Chinese used old fishing nets to make the world's very first piece of paper.
- Paper recycling has been around as long as paper itself. Paper companies have always recognized the environmental and economic benefits of recycling. In recent years, paper recycling has become popular with everyone as a way to help protect our environment by reusing our resources and conserving landfill space.
- Today, about 87% of the more than 520 paper and paperboard mills in the U.S. recycle some recovered paper. Today, recovered paper provides over one-third of all the fiber used at U.S. mills.
- Americans recover nearly 50% of all the paper they use.
- More paper is recovered in the United States than is sent to landfills.
- In the U.S., paper accounts for two-thirds of all the packaging material recovered for recycling -- more than glass, metal, and plastic combined!
- Recovered paper supplies close to 40% of the fiber used to make all paper and paperboard products in the U.S.
- Every day, U.S. papermakers recycle enough paper to fill a 15-mile long train of boxcars.
- A typical newsprint machine produces as many as 500 tons of paper every day. In the early 21st century, use of recovered paper is projected to grow twice as fast as the use of wood pulp.

These facts are presented by individual scientists, engineers, and researchers who work at universities, research laboratories, and companies across the country. They work at the science of papermaking every day -- researching and testing the facts. It is their full-time job to understand and report the facts concerning the nature of forest practices, the processes involved in papermaking, and how these affect the environment -- good and bad.

TAPPI is the leading technical association for the worldwide pulp, paper, and converting industry. The Association provides a neutral forum for members to come together to share their technical knowledge and expertise in an effort to further advance professional achievement and sound technology.