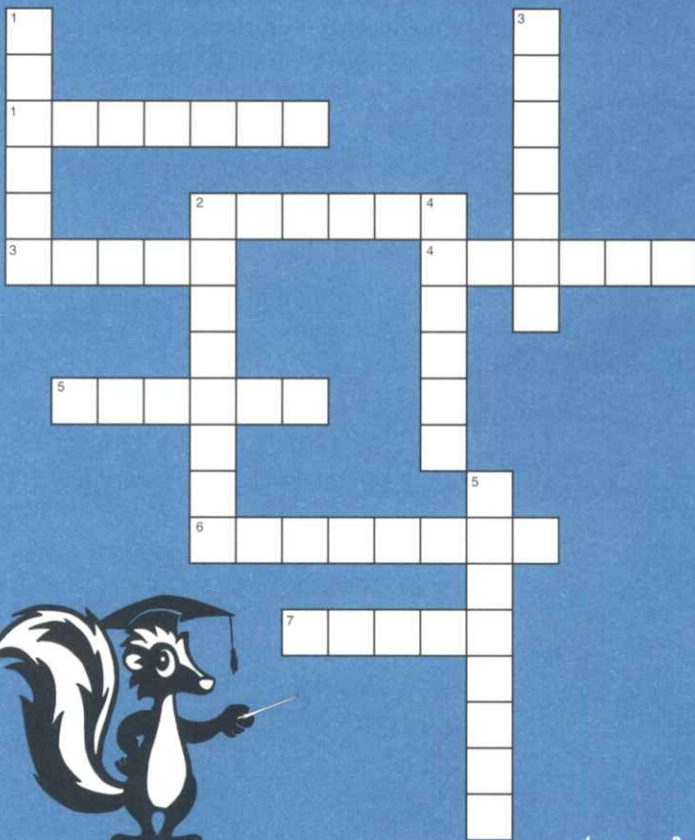


# GREENQUIZ

## CROSSWORD PUZZLE



Answers on Page 5

### ACROSS

1. Our sense of smell can detect one particle of TRS gas in one \_\_\_\_\_ parts of air.
2. TRS stands for Total Reduced \_\_\_\_\_.
3. After they are recycled several times, wood fibers become too \_\_\_\_\_ to be made into paper again.
4. Kraft pulping requires less purchased \_\_\_\_\_ than other pulping methods.
5. The natural "glue" which holds wood fibers together is called \_\_\_\_\_.
6. \_\_\_\_\_ fibers are short.
7. The pulping process which uses heat and chemicals is called \_\_\_\_\_ pulping.

### DOWN

1. Pulping breaks wood chips down into individual \_\_\_\_\_.
2. Long fibers give paper what quality?
3. Kraft pulping enables mills to use a wide variety of wood \_\_\_\_\_.
4. Mills use air pollution control technology to \_\_\_\_\_ odors that are formed.
5. \_\_\_\_\_ fibers are long.

### SOURCES

U.S. EPA, 1995.  
 American Forest & Paper Association, 1999.  
 Industrial Environmental Control, TAPPI PRESS, 1994.  
 McGraw-Hill Encyclopedia of Science & Technology, 6th Edition.

For more answers write

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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 and the processes involved in paper-making, and how these affect the environment.

TAPPI, the Technical Association of the Pulp and Paper Industry, is a professional society for individuals working in the industry worldwide. 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.



# EARTH ANSWERS



## • WHAT YOU NEED TO KNOW •

## WHY DO SOME PAPER MILLS HAVE AN ODOR?





## If sulfur produces an unpleasant odor, why use it?

In kraft pulping, the sulfur-based chemicals are used to remove the **lignin** (the natural glue-like substance which holds wood fibers together) from the wood chips. These chemicals are also needed to protect the **cellulose**, the wood fiber material which bonds together to make paper.

Without sulfur, much of the cellulose would be weakened or destroyed. As a result, not only would the resulting paper be weaker, it would take more pulp to make the same amount of paper. So, in a sense, using sulfur allows manufacturers to make more paper from fewer trees.



## Did you know...

*Because of their low odor threshold, some TRS gases are actually used to protect us.*

*Many homes are heated with natural gas, an odorless gas which can cause explosions when exposed to flame, and which can be harmful or even deadly when inhaled.*

*TRS gases such as mercaptan or dimethyl disulfide are commonly added to natural gas so that potentially dangerous gas leaks can be detected before they cause any harm.*

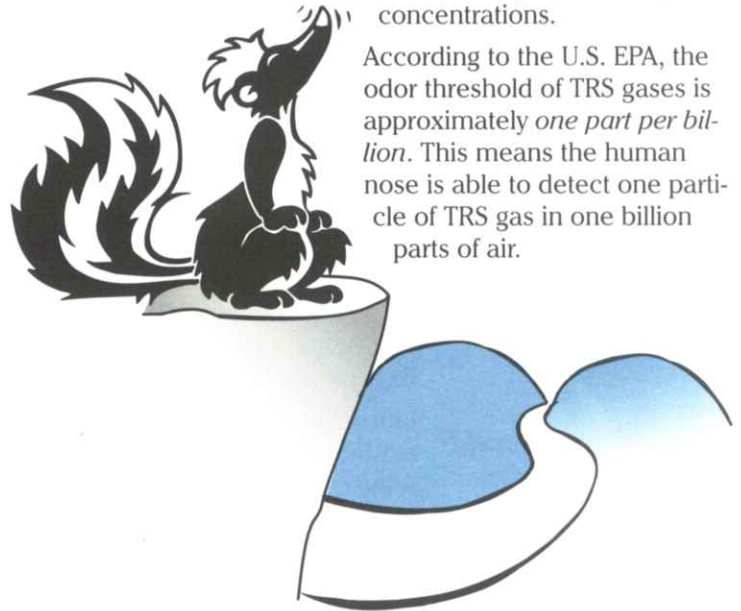


## Does the air near pulp mills contain high concentrations of sulfur gases?

No. Concentrations of sulfur compounds in the exhaust gases emitted by kraft mills are actually very low. To protect health and the environment, all kraft mill process equipment is regulated by government pollution control agencies to keep TRS emissions below specified levels.

However, TRS concentrations that are well below government-set levels are still detectable by our sense of smell. Much like perfume, sulfur compounds have a low **odor threshold**. That means their odor can be smelled easily at extremely low concentrations.

According to the U.S. EPA, the odor threshold of TRS gases is approximately *one part per billion*. This means the human nose is able to detect one particle of TRS gas in one billion parts of air.



Geographic and climatic conditions can influence pulp and paper mill odor. Odors from mills in low-lying areas or valleys may sometimes be more noticeable, due to more frequent temperature inversions and light winds in these geographic areas.

Odor may be more noticeable at night and in the early morning, because temperature inversions are most likely to occur at these times of day, especially when skies are clear.



## Why do some paper mills have an odor?



The odor you may have noticed when passing by certain pulp and paper mills may have been produced during **kraft pulping**. The kraft pulping process uses heat and chemicals to **pulp** wood chips, breaking them down into individual **fibers** for papermaking. Fibers are tiny strands of organic plant material (**cellulose**) which bond together to make paper. A mixture of fibers is called **pulp**.

The chemical mixture used in kraft pulping contains sulfur and other chemicals. The odor you may have detected, which most people describe as a “rotten egg” smell, is the result of a chemical reaction between the sulfur, other pulping chemicals, and the natural chemicals contained in the wood chips. This reaction produces gaseous sulfur compounds called “**Total Reduced Sulfur**,” or **TRS**, gases.

The U.S. Environmental Protection Agency (EPA) has determined that these TRS compounds are an “odor nuisance,” not a health concern, at levels found in the atmosphere around kraft mills.

## Do all pulp and paper mills have this odor?

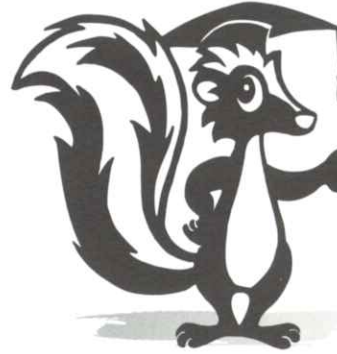


No. There are many different types of pulp and paper mills, and not all of them use kraft pulping. Some paper mills do not make their own pulp, but instead purchase the pulp they need from other mills. Some pulp mills use methods other than kraft pulping to make their pulp.

Although these other types of mills may have some odor, it is likely to be less noticeable and of a different nature than the odor from kraft pulping.



## Then why use kraft pulping?

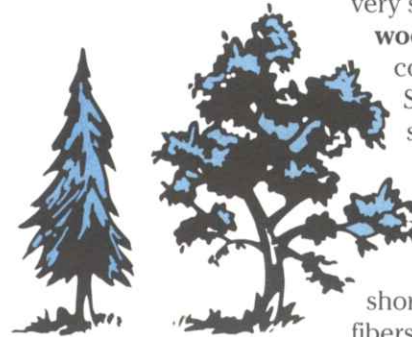


There are several important reasons why mills use the kraft process for pulping. First, kraft pulping is a highly efficient process. It requires less purchased energy (such as fossil fuels and electricity) per ton of



pulp than most other pulping methods. The chemicals used in kraft pulping can be used again and again to pulp new wood chips.

Another important reason why mills use kraft pulping is to utilize the fibers from a wide variety of wood species. **Hardwood** species, such as oaks, contain very short fibers, while **softwoods**, such as pines, contain comparatively long fibers. Short fibers give paper smoothness, while long fibers provide strength.



Depending on the type of paper being manufactured, pulp must contain short, long, or a combination of fibers to give the paper its desired qualities. Kraft pulping is the only pulping process which can effectively pulp both hardwood and softwood species.

## Have you noticed...

*There is much less odor near pulp and paper mills than there once was.*

*As part of their pollution prevention programs, mills continually install updated, more effective air quality equipment. By routing TRS gases through this equipment, mills can reduce kraft mill odors significantly.*

*Because of new technology, levels of TRS gases released during kraft pulping are continually falling.*



## What is being done to further reduce the odor?

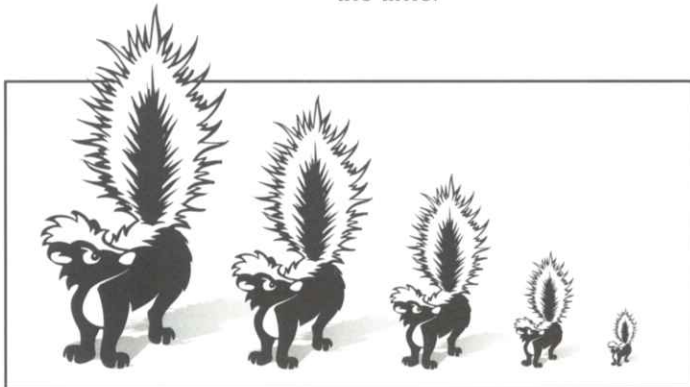


The pulp and paper industry uses odor control technology throughout the pulping process. First, improved process designs reduce the amount of TRS gas produced in the first place.

Mills then use air pollution control technology to reduce odors that are formed. TRS compounds are sprayed with chemically-treated shower water, or captured and burned at high temperatures in an incinerator or steam-producing furnace. Sometimes the energy value of the gases can be reused within the mill.

Today, the U.S. pulp and paper industry produces about 25 million more tons of kraft pulp each year than it did in 1970. Even with this increase in production, the industry has succeeded in actually *reducing* odor-causing TRS emissions from kraft pulping by as much as 90-95%! For every ton of kraft pulp produced in the U.S. today, as much as 95% of the associated odor has been eliminated.

Industry engineers are continually looking for new ways to reduce or eliminate odor. As new pulping and air pollution control methods continue to be developed, pulp mills will be the source of less and less odor all the time.



1970 ————— Today

The U.S. paper industry's long-standing commitment to reducing odor has resulted in an estimated **95% decrease** in TRS emissions per ton of pulp produced.



## Why use wood chips at all? Can't we get all the paper we need by recycling?

This is a good question. We do recycle a lot of paper. In fact, about 45% of the paper used in the U.S. is recycled back into new paper and paper products, and the U.S. paper industry is working to increase this amount to 50%.

However, the world's demand for paper is simply too great to rely on recovered paper as the industry's only fiber source. The United Nations estimates that there are at least 5 billion people on earth today, with the population increasing by about 90 million every year.



Recovered paper cannot provide enough fiber to meet the world's tremendous demand for paper. Wood and other natural fiber sources must be used to supply the remaining fiber.

Another reason is that wood fibers can only be recycled five to seven times before they become too short to be made into paper again.

Consequently, new wood fiber is needed to replace the unusable recycled fiber.

