

SCIENTIFICALLY SPEAKING:

# The Facts About Kiln-Dried Logs

If you are shopping for your dream log home, you've probably noted conflicting claims about air-dried versus kiln-dried logs. Sorting out the scientific facts from the fiction can be extremely confusing. This brochure is designed to provide you with factual information on the kiln-drying process and the importance of building with properly seasoned logs.



Our many years of experience in the wood products industry lead us to believe that properly kiln-dried logs provide the best building material possible, and this approach is backed by independent experts in the wood technology industry. Get all the facts before you buy—after all, what's more important than the quality of logs in your dream log home?

SOME ANSWERS TO YOUR QUESTIONS IN...

# The Great Log Debate

## Why does Kuhns Bros. kiln dry its logs?

We've been in the wood products business for more than 50 years, and our experience provides compelling evidence that kiln-dried logs provide the most stable, trouble-free building material. We've conducted numerous joint research projects with independent researchers—including Penn State University's Dept. of Forestry—to continually refine our kiln-drying technologies, and we currently operate 12 kilns at our manufacturing headquarters to dry our logs, beams, purlins, and other wood products.

## How does the process work?

Kiln drying is a complex science. Here's how our process works. A stack of large dimensional lumber (or cants) is placed in a sealed building and the temperature is slowly raised to 170°F. Large reversible fans circulate the heated air to help maintain a consistent drying rate throughout the kiln, and the moisture-laden air is removed from the kiln by dehumidifiers. The drying rate is carefully monitored, because the outside perimeters of the cants naturally tend to dry faster than the centers. Uncorrected, this imbalance may cause severe checking (cracking).

## How is the final moisture content determined?

This can be measured in a variety of ways. The most popular device is the "moisture meter," which measures only the outside portion of the wood, which tends to be the driest. We use the much more accurate "oven dry"

ratio method. Samples from each kiln "charge" are weighed, then dried completely in an oven and weighed again. The ratio between the two readings represents the average moisture content of the logs, inside and out. After the logs in each charge average less than 15 percent moisture content, they are ready for milling to the final log profile. The moisture content of Kuhns Bros. logs is guaranteed in writing.



## How much extra does it cost to kiln dry logs instead of just letting them "air dry"?

A few thousand dollars, depending on the size of the home. That's just a minimal percentage of the overall cost of the project, and we believe that it's the best investment you can make in your log home.

## Why...what benefits do I get?

Wood must be conditioned to the moisture content it will assume during its service life—otherwise, it will have a tendency to shrink and twist to some degree. You can see the final beauty and integrity of each log before it is placed in the wall, and you don't have to worry about what the home is going to look like after the logs have finally dried out.

## But even more specifically:

a) Kiln-dried logs are "pre-shrunk" before milling to a final profile, so the logs are stable and uniform compared to unseasoned logs. No severe shrinking or warping occurs.

- b) Any in-service checking, warping and twisting is minimized, because it occurs in the kilns prior to milling and final construction. Defective logs are graded out by trained inspectors. Graded logs are stamped with the Log Home Council's certification for Stress Grades.
- c) Using high heat, logs are sanitized, killing mold, fungi (which causes wood decay), plus any insects, their eggs or larvae.
- d) Pitch in the wood is crystallized, reducing the possibility of the sticky substance seeping to the surface of your log wall.
- e) Interior and exterior finishes can be applied immediately following construction, which is more convenient and provides immediate protection. Also, applications absorb deeper and last longer.
- f) More than 10,000 pounds of water are removed from the typical home, significantly reducing the weight of the logs. Even the longest logs are easily handled by two people.
- g) Properly dried logs provide the higher insulation values, reducing energy costs and increasing the comfort of your home.

## Can air-dried logs provide the same benefits?

The rate and degree at which moisture is removed from wood is dependent upon the temperature, relative humidity and air velocity of the environment. Kilns provide control over these factors. Air drying typically takes place in an open-air storage yard—with little or no control over the environmental conditions. While it is technically feasible

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# The Experts Speak Out

## ON THE IMPORTANCE OF BUILDING WITH PROPERLY DRIED WOOD...

*The recommended moisture content of wood should be matched as closely as is practical to the equilibrium moisture content (EMC) conditions in service.*

- USDA, Forest Service, Forest Products Laboratory, Madison, WI  
Wood Handbook, Wood as an Engineering Material (FPL-GTR-113) Chapter-12; William T. Simpson

*Logs used for house logs should be dried prior to being placed in service, and a reasonable target moisture content is 15 percent. That way, most of the shrinkage has already taken place. Building with "green" logs, which are harvested from living trees, will result in considerable shrinkage in walls of log homes and requires specialized construction techniques.*

- Tom Gorman, PE, University of Idaho and licensed engineer

*Properly dried lumber can be cut to precise dimensions and machined more easily and efficiently; wood parts can be more securely fitted and fastened together with nails, screws, bolts, and adhesives; warping, splitting, checking, and other harmful effects of uncontrolled drying are largely eliminated; and paint, varnish, and other finishes are more effectively applied and maintained.*

- USDA, Forest Service, Forest Products Laboratory, Madison, WI  
Wood Handbook, Wood as an Engineering Material (FPL-GTR-113) Chapter-12; William T. Simpson

*In the living tree, wood contains large quantities of water. As green wood dries, most of the water is removed. The moisture remaining in the wood tends to come to equilibrium with the relative humidity of the surrounding air. Correct drying, handling, and storage of wood will minimize moisture content changes that might occur after drying when the wood is in service and such changes are*

*undesirable. If moisture content is controlled within reasonable limits by such methods, major problems from dimensional changes can usually be avoided.*

- USDA, Forest Service, Forest Products Laboratory, Madison, WI  
Wood Handbook, Wood as an Engineering Material (FPL-GTR-113) Chapter-12; William T. Simpson

## ON "AIR-DRYING"...

*The advantage of air drying large timbers is the low initial cost compared to kiln drying. However, air drying large timbers usually takes longer than a year to achieve moisture content levels that are reasonably acceptable for construction. Also, the limitations or disadvantages of air drying are related to reliance on the ambient air temperature, relative humidity and air velocity, resulting in very little control of drying rates. There may be slow drying rates over the winter months. Hot, humid days with little air movement will promote stain development. A hot, dry wind increases the drying rate and may promote severe surface checking. Proper kiln drying provides much more predictable, controllable results.*

- Dr. Paul Smith, Professor of Forest Products Marketing, Penn State University

*Limitations of air drying are generally associated with uncontrolled drying. The drying rate is very slow during the cold winter months. At other times, hot, dry winds may increase degrade and volume losses as a result of severe surface checking and end splitting. Warm, humid periods with little air movement may encourage the growth of fungal stains, as well as aggravate chemical stains.*

- USDA, Forest Service, Forest Products Laboratory, Madison, WI  
Wood Handbook, Wood as an Engineering Material (FPL-GTR-113) Chapter-12; William T. Simpson

## ON THE KILN-DRIED ADVANTAGES...

*Proper kiln-drying procedures, as practiced by Kuhns Bros. Log Homes, control the drying environment and reduce the amount and severity of drying induced defects. Any piece of wood that has excessive warp or checking may be removed from the inventory prior to shipment to the customer. Drying wood prior to installation provides an opportunity for the wood to maintain relatively stable dimensions during service.*

*The advantages to kiln drying compared to air drying include:*

1. reduced drying time
2. better control over the final moisture content
3. reduce unwanted defects
4. final shrinkage occurs during drying in the kiln and not in-service
5. the ability to control drying in the center portion of the wood increases protection against fungal degradation
6. temperatures at 160°F or above solidifies the resins in softwoods, eliminating the problem of resin bleeding

- Paul Blankenhorn, Ph.D., Professor of Wood Technology, Penn State University

*There are two important differences between AD and KD. In a kiln, the wood is usually heated above 130°F, which kills all insects, eggs, and fungi. Second, with resinous softwoods, the heat drives off the resin that would be liquid and runny at room temperature.*

- Dr. Gene Wengert, Professor Emeritus in Wood Processing, Department of Forestry, University of Wisconsin (Madison)

*Specific kiln schedules have been developed to control temperature and relative humidity in accordance with the moisture content and stress situation within the wood, thus minimizing shrinkage-caused defects.*

- USDA, Forest Service, Forest Products Laboratory, Madison, WI  
Wood Handbook, Wood as an Engineering Material (FPL-GTR-113) Chapter-12; William T. Simpson

## The Great Log Debate *(continued)*

to air-dry logs to 15 percent moisture content, it could take as long as two years of storage to reach that target moisture level. Plus, the local climate and weather conditions impact the seasoning of the logs, so the results are much more unpredictable. In addition, air-dried logs are not sanitized, the pitch inside the logs can seep to the surface, and there is typically a waiting period after construction prior to the application of preservatives and finishes. Finally, when building with unseasoned logs, allowances must be made for "settling" or shrinking of the logs after they are placed in the wall.

### **Will the kiln-dried logs in the wall shrink after construction?**

With unseasoned logs, yes—and it can be severe, depending on the moisture content of the logs. With properly kiln-dried logs, that simple question requires a detailed answer. Wood is a wonderful yet imperfect building material, in large part because it is affected by the surrounding environment, which can vary dramatically depending on your geographic location. Temperatures and humidity levels on the inside and outside of the home also impact the dynamics of log shrinkage. When solid logs are placed in service, the interior surface is exposed to relatively stable conditions compared to the outside temperature and humidity level. We kiln dry our logs to an average of less than 15 percent to best condition them to these two fluctuating environments. The inside profile of our logs sometimes shows a small amount of shrinkage, but the center and outside portions remain stable and weather-tight. Our logs require no provision for settlement after construction.

### **Will the kiln-dried logs reabsorb moisture?**

After our logs are removed from the kiln and milled to the final profile, they are covered with a weather-tight wrap for protection from the elements. During kiln drying the cells in the wood shrink. Also, the sugars and other chemicals in the wood are chemically altered, and along with the minerals are left behind and deposited in the resin ducts and cell walls in the wood. These deposits help retard adsorption of moisture in the cell wall. After the wood is dried below 15 percent moisture content, the moisture content of the wood remains relatively constant unless the wood is subjected to high humidity or water. Logs placed in service in a log wall and exposed to a constant high humidity (90 - 95 percent relative humidity) will gain moisture on the outside portion only—but this occurs at a slow rate. Under constant high humidity conditions the moisture content will increase to a maximum of 20 - 21 percent after a very long period of exposure. Logs exposed

to occasional rain may have the moisture content increase above 20 percent; however, the water evaporates from the log after the rain. Note that the immediate application of water-repellent wood preservative, which we recommend for all of our homes, plays a vital role in retarding adsorption of water that may occur due to exposure of the wood to high humidity or rain.

### **If I choose a kiln-dried manufacturer, what questions should I ask?**

More and more log home manufacturers claim to kiln-dry their logs, but unfortunately there are no industry standards. Some companies' logs spend only a few days in the kiln; our controlled process requires more than 30 days for each kiln charge. There are huge differences in the logs that kiln-dried manufacturers supply with their packages, so qualify the companies you are considering by asking the following questions:

1. How and where are the logs dried?
2. What temperature levels are achieved in the kiln?
3. What moisture content are the logs dried to, and is the moisture content guaranteed in writing?
4. What process is used in determining the moisture content—moisture probe or the "oven-dry" ratio method?

### **How can I find out more?**

The best way to investigate the value of kiln-drying is to get a first-hand look at our plant in Lewisburg, PA. Just call ahead (1-800-326-9614) to arrange a personalized kiln tour. Or, if you are seriously considering the purchase of a log home, why not sign up for one of our Construction Workshops? Tours of our manufacturing headquarters are part of the workshop agenda, and you'll also learn more about design, financing, and get hands-on construction experience. For more information on workshops please see your Kuhns Bros. sales representative or visit us on-line [www.kuhnsbros.com](http://www.kuhnsbros.com) and click on the [Special Events](#) page. We look forward to hearing from you and wish you all the best in achieving your dream!



While believed to be accurate at the time of publication, specifications herein can change without notice.

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If there is no sales representative listed in this box and you would like more information on America's finest, most complete log home packages, please contact us at 1-800-326-9614 or...

Visit us online at [www.kuhnsbros.com](http://www.kuhnsbros.com)

