Kiln Drying Basics for the Small Producer

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Downloadable References

- Go to [www.fpl.fs.fed.us](http://www.fpl.fs.fed.us)
- Look under publications
- Drying hardwood lumber
- Dry Kiln operator’s manual
- Dry kiln schedules for commercial woods
Hard References

- Go to www.forestprod.org
- Look under publications
- Drying hardwood lumber
- Dry Kiln operator’s manual
- Dry kiln schedules for commercial woods
2010 Dry Kiln Operators’ Courses

• Haywood Community College
  – Clyde (Near Asheville NC)
  – Whit Whitmire
  – Phone: 828-565-4246
  – E-mail: mwhitmire@haywood.edu

• University of Minnesota
  • August 16-19, 2010
  • Harlan D. Petersen P
  • Phone: 612-624-3407
  • E-mail: harlan@umn.edu
Warning: Decide if it is a hobby or a business?

- Don’t be cheap
- Do things right
- Go to a kiln operator’s short course
Log Protection

• Log protection is critical to avoid stain and splits
• Rapid log turnover is one of the most cost effective ways to avoid problems
• End coating logs with wax or anti stain chemical will help if longer storage is used
Quality Stacking

- Uniform sized lumber
- Uniform sized, dry sticks
- Cross outs and sticks should be in vertical alignment
- Protect the ends
Principles Of Drying

- Heat
- Humidity
- EMC
- Airflow

Figure 7.2—A typical package-type dry kiln for hardwood lumber.
Heat

• Evaporate water
• Move water molecules from center of the lumber to the outside
• Wood is weaker at higher temperatures
• Use only enough heat to get the job done
• Dry bulb temperature
Humidity

- Relative Humidity
- Allows water to evaporate from the lumber surface
- Controls the drying rate at the beginning of drying
- More humid on the exiting air side of a load
- We use a wet bulb or Equilibrium Moisture Content (EMC) wafer to measure humidity in a kiln
- Need airflow past wet bulb to get an accurate reading
Airflow

- Used to bring energy to the wood, and take away moisture
- Too little airflow can lead to slow drying, variable drying and staining
- Too much airflow can lead to checking
Airflow

• Oak 300-350 FPM (1.5-1.8m/sec.)
• Poplar 600-700 FPM (3.1-3.6m/sec.)
• Hard Maple 350-450 FPM (1.8 -2.3m/sec.)
• White Pine 600-700 FPM (3.0 -3.6m/sec.)
• Southern Pine (low temp) 650-750 FPM (3.3-3.8m/sec.)
• Southern Pine (high temp) 1200-1600 FPM (6.0-8.1m/sec.)
Hot Room Drying

- Air dry or shed dry first
- Move lumber to progressively warmer and dryer environment
- End up in a heated part of your house for at least one heating season for 4/4 lumber
Solar Drying

• Sounds like a good idea (using the sun, etc)

• Need production all of the time

• Can get expensive with all the bells and whistles

• Need to be selective on what you dry (stain & checking)
Solar Drying

• Solar collectors gather approximately 1000 to 1200 BTUs per square foot
• As a general rule have the solar collector at an angle from horizontal as the collector is located north or south of the equator
• In this hemisphere face it south
• It takes approximately 1000 BTUs to evaporate one pound of water
### Solar Drying

<table>
<thead>
<tr>
<th>Species</th>
<th>Daily MC% Loss Target</th>
<th>Weight Per 1 MBF Dry</th>
<th>Weight Of Moisture Loss</th>
<th>MBTUs/MBF/Day or area in square feet of solar collector</th>
</tr>
</thead>
<tbody>
<tr>
<td>SYP</td>
<td>30.0%</td>
<td>2710 lbs.</td>
<td>813</td>
<td>813</td>
</tr>
<tr>
<td>Poplar</td>
<td>30.0%</td>
<td>2315 lbs.</td>
<td>695</td>
<td>695</td>
</tr>
<tr>
<td>H. Maple</td>
<td>5.0%</td>
<td>3045 lbs.</td>
<td>152</td>
<td>152</td>
</tr>
<tr>
<td>Cherry</td>
<td>4.5%</td>
<td>2692 lbs.</td>
<td>121</td>
<td>121</td>
</tr>
<tr>
<td>Red Oak</td>
<td>2.75%</td>
<td>3270 lbs.</td>
<td>90</td>
<td>90</td>
</tr>
</tbody>
</table>
Solar Drying

• For slow drying species the solar collector ratio of 100 ft$^2$ per MBF can be used

• For moderately drying species the solar collector ratio of 200 ft$^2$ per MBF should be used
Solar Drying

Products J 31(9):10-12.
Present contact -- A. M. Sehgal
Hood Seasoning Branch
Forest Research Institute
Dehra Dun
U. P., INDIA

3 Layers of plastic

2.6 m
1.1 m
0.0 m
25°

A: Drying Chamber
B: Solar Collector
C: Alumínium Skin Air Flow
D: Through Collectors
E: Air Discharge to Internal Zone
F: Internal Zone, Multidirectional
G: Humidistat for Moist Control
H: Humidifier
I: Fan/Blower
J: Fan/Blower
Solar Drying - Poplar to Oak
Suggestions

• Start with an easy to dry wood and learn your kiln
• Top vent is for overheat (can get up to 140°F)
• Bottom vents are to allow moist air to escape and bring in fresh air
• Baffle well
• Can add small dehumidifier and or heater
Dehumidification Drying

- No boiler needed
- No vents, closed loop system
- Energy efficient but you are using electricity
- No heat up system or humidifying system
Dehumidification Drying

- Compressing gas heats the gas up, which in turn can heat the air.
- Expanding gas cools the gas down, which is used to lower the air temperature or condense water out of the air stream.
Dehumidification Drying

- Slow drying species, oak – 0.50 to 0.75 hp/mbf
- Moderate, ash – 1.00 hp/mbf
- Fast drying, pine – 1.50 to 2.00 hp/mbf
- Better to slightly undersize than oversize
Dehumidification Drying

- Compressor and electrical outside the kiln
- Stainless steel coils
- Ability to reach higher temperatures (160°F)
- Enough airflow
- Well insulated
- Auxiliary heat and humidification system
Cost

- Energy Cost reported to be between $50 to $80 per MBF
- Need a well insulated building!!!!
Using a reefer
Conventional Steam Kiln

Figure 2.6—Package-loaded kiln with fans connected directly to motors. (MLSS 5598)
Conventional Steam Kiln

- My former student, Miguel Angel Camara Rubio, as part of his Master’s project built a kiln at his family business in Mexico City.
- He wanted a kiln that was highly flexible in terms of ability to dry different species and thicknesses.
Pine lumber – notice the quality of stacking
Hardwoods

Lysiloma spp. – T’zalam
Variable speed fan control gives a lot of flexibility
Notice what gives him good results—good sample techniques and records.
Small kilns can also be used to heat treat pallet material as well as dry lumber.
Other Alternatives
Other Alternatives (Small)

- 7,000 BF capacity
- Direct fired
- Computer controlled
- Optional 6 MC% resistance sensors
- Five 20” fans, 2HP
- Bi-fold doors
Good luck!